ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LV, No. 20. CHICAGO, SATURDAY, NOVEMBER 13, 1909 ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY.

CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO.

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

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SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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HYDROELECTRIC POWER IN THE CENTRAL WEST.

Great opportunities exist for the use of hydroelectric power in the Central West, and comparatively little has been done to take advantage of them thus far.

From Chicago to New Orleans, and from Omaha and Kansas City to Cleveland and Cincinnati, including St. Louis, Indianapolis, Columbus, Louisville, Memphis and Galveston, the prominent hydroelectric plants are very few in number.

In this great territory extending more than seven hundred miles east and west and more than eight hundred miles north and south, with its tens of millions of people, hundreds of thousands of horsepower could be used from hydroelectric plants. Much the largest hydroelectric plants now operating in this territory are that on the Chicago drainage canal at Lockport, and that on the Tennessee River at Hale's Bar, the former designed for an ultimate capacity of 43,000 and the latter for 50,000 horsepower in electric generators.

In the meantime, half a dozen large rivers and numerous smaller ones are falling hundreds of feet on their way through this great central region to the sea. According to the recent report of the United States Board of Engineers on the proposed fourteen-foot waterway from Chicago to New Orleans, the 10,000 cubic feet of water per second that the Sanitary District of Chicago is authorized to divert from Lake Michigan is capable of developing 100,000 horsepower before it reaches the Illinois River at Dresden Heights. In its course of some 325 miles from this point to its mouth on the Mississippi the Illinois River falls about 126 feet, and even with this gentle slope it is believed that the flow of 10,000 cubic feet per second can be made to develop tens of thousands of horsepower.

From Dubuque, Iowa, to the Gulf of Mexico, the Father of Waters falls 585 feet along its course of 1,672 miles, with rapids at Rock Island and Keokuk. Between Le Claire and Muscatine, Iowa, a distance of forty-three miles by the river, the Mississippi falls thirty-two feet, passing Rock Island on the way. Again, from Montrose to Keokuk, Iowa, the Mississippi falls twenty-three feet in a distance of twelve miles. While the possible heads of water between these points are thus moderate, the great volume of the Mississippi might suffice to develop powers large enough to warrant transmission to Chicago, which is about 150 miles from Rock Island, and to St. Louis, which is about 140 miles from Keokuk.

From Omaha, Neb., to its mouth on the Mississippi the

Missouri River falls 555 feet in a distance of 660 miles, or less than 0.9 foot per mile. Between Plattsmouth and Nebraska City, Neb., however, the fall is 65 feet along fifty-six miles, and from Waverly to Dewitt, Mo., a distance of thirty-two miles, the fall is thirty-one feet.

Of course a local investigation is necessary in every instance to determine whether it is practicable to develop a waterpower, and in broad, low parts of the valley of rivers that have only gradual falls, like those just noted on the Missouri, the cost of dam construction and of land damages may forbid any development. Where a long gradual fall in a river is continuously confined between high banks, however, and land is of little worth, the very fact of a gradual fall may add greatly to the value of the waterpower, because of the storage area and regulation of flow thus made practicable. Take, for illustration, the Missouri River between Plattsmouth and Brownsville, Neb., with its fall of sixty-five feet, if the river were confined between high banks along this stretch of fifty-six miles, and other conditions made it practicable to create a reservoir of this length, the storage area thus obtained would obviously add greatly to the earning power of a possible development.

Along the Ohio River, from Pittsburg to its mouth at Cairo, Ill., the distance is 963 miles and the fall 425 feet, or only 0.44 foot per mile. The only substantial fall in the Ohio at any one point is at Louisville, Ky., and from that city to New Albany, Ind., the drop in the river is twenty-seven feet along a distance of four miles. Waterpower is now developed at this point, but no investigation has been made to determine whether a substantial increase of power could be obtained by further improvements.

From Tennessee Pass in Colorado to Hutchinson, Kan., the Arkansas River has a length of 626 miles, and from Hutchinson to Wichita, a distance of thirty-nine miles downstream, the fall in the river is 278 feet. This stretch of thirty-nine miles on the Arkansas River is distant about 130 miles from Topeka, and 180 miles from Kansas City.

Logansport, Ind., is 155 miles from the source of the Wabash River, and the distance from Logansport to Lafayette is fifty miles downstream. Along this stretch of fifty miles the Wabash River falls seventy-seven feet, and the distance from this part of the stream to Indianapolis is some sixty-five miles.

Cleveland, Ohio, is no more than 200 miles from Niagara Falls, so that the transmission of energy from the cataract to that city would be only forty miles longer than that to Syracuse and Auburn. Another additional stretch of 200 miles would carry Niagara power into Cincinnati. While a transmission of Niagara power over a distance of 400 miles to Cincinnati may or may not be practicable from the financial point of view, it is, of course, entirely possible as a feat of engineering.

The Tennessee River is one of the great power streams of the United States, for its flow below Chattanooga ranges between 5,000 and more than 300,000 cubic feet of water per second, and it falls 345 feet from that city to its mouth on the Ohio at Paducah, Ky., a distance of 452 miles. In spite of its moderate average slope, the Tennessee River has sufficient fall at a number of points to make power development on a large scale practicable. At Hale's Bar, thirty-three miles below Chattanooga, a fall of thirty-nine feet has been developed, and a hydroelectric plant designed for 50,000 horsepower constructed, as mentioned above.

About 170 miles downstream from Chattanooga, in a stretch of thirty miles between Milton Bluff and Florence, the Tennessee falls 127 feet, and thus offers opportunity for the development of a far greater power than that at Hale's Bar. This stretch of river with the fall of 127 feet is distant about 200 miles from Memphis, Tenn.

THE INTERURBAN-RAILWAY SITUATION IN MASSACHUSETTS.

Two electric interurban-railway projects of general interest are at present before the Massachusetts Railroad Commission seeking certificates giving them the right to build high-speed lines between Boston and several important cities lying in the northeastern portion of the state. The proposed railroads differ from the interurbans that thread the highways and byways of the East in avoiding grade crossings of any kind, and by their assignment to the work of bringing communities from fifteen to thirty miles from the primary terminal city into immediate touch with the larger center of population and affairs. The capitalists and engineers behind each project hope to bring the areas tapped within the critical limit of running time where the patron whose hours are valuable forsakes the comparatively slow street railway for the less-frequent but swifter steam train. The older project is that of the Boston & Eastern Electric Railroad Company, and the other that of the Boston, Lowell & Lawrence Electric Railroad Company. Both are trying to get a foothold under a law passed about three years ago which recognized the need of an entirely new type of transportation in Massachusetts, occupying a position midway between the steam railroad and the street railway, and fulfilling functions that neither the urban rapid-transit system extended nor the cross-country highway trolley line could achieve.

Without going into the details of the proposed lines, it is noteworthy that the technical aspects of each project have been studied with the most painstaking care by engineering organizations of national reputation. The questions of location have been considered on the basis of detailed surveys of every foot of the proposed route in each case; the estimates of cost have been prepared only after the most thorough study of schedules and power requirements; and the probable earnings have been deduced from tabulations of the populations and their growth in the territory to be served. It is safe to say that preliminary expenses of the two railways, including investigations, reports, estimates, plans, and the fees of counsel

appearing at hearings have easily reached $75,000. The thoroughness with which each case has been worked out, however, proves that on large enterprises of this character, representing a combined investment of probably $18,000,000, it is of the utmost importance, from every point of view, to take account of all possible contingencies, and to present before the reviewing commission data so complete that engineering objections can in all cases be faced with confidence.

Naturally the two projects have encountered the active opposition of the steam and street-railway companies now operating in the territory through which it is proposed to run the lines. The commission must take all such facts into account in deciding whether these roads shall be built or not, having due regard for the existing investments as well as the public accommodation. Since the law enacted in 1906 provided, however, for the creation of a new type of electric railroad especially adapted to handle a class of traffic which the slow-running street car cannot handle satisfactorily, and which the overburdened steam lines cannot cope with, the prospects are on the whole favorable for the ultimate construction of the road. Matters have gone far enough to show that the promoters are in earnest, and there is no question that the possibilities of modern equipment on an unrestricted right-of-way in a territory as thickly populated as Eastern Massachusetts are capable of quickening the pulse of traffic and stimulating the prosperity of those rather conservative communities in a most interesting and beneficial fashion.

The effect on the present facilities in the territory cannot be predicted at long range, but if the fears of the existing companies are realized we shall be greatly surprised. It is going to be settled before many years that suburban traffic cannot be properly or efficiently handled by the steam locomotive; and that ample track capacity is essential for taking care of this class of business even where electrified service is in operation. The steam roads operating in our larger cities have had time enough now to make up their minds in regard to the desirability of electrification, and if other people are sufficiently far-sighted to enter the field of suburban-traffic handling, there should be no complaint. The railroads might as well realize now as later that the public is going to demand electrical operation within certain districts with a more insistent voice each year, and if this clean, swift and frequent service is not provided by the railroads, it will be established by others. Doubtless in some cases the cost of additional right-of-way will be so great that new lines will have to be built, either by the railroads themselves or by companies like those now fighting their way in Massachusetts for a standing place on the face of the earth.

As for the street-railway lines in districts which the high-speed interurban is preparing to enter, it is clearer each year that the short-haul traffic is the life of the trolley system, and that if it is operated to the fullest extent of its physical and commercial possibilities as a collector and distributor for the new type of interurban, with due cultivation of local patronage, the coming of a new and fast line may actually be a benefit instead of a rival. Electrical methods in every field are so flexible and so powerful in attracting patronage that where a new field is developed there is on the whole reason to anticipate a general gain in public and private welfare.

DOES IT PAY TO CONDENSE?

Under the above caption *The Electrical Engineer,* of London, England, prints the following item:

"At one of the London power stations it has been found that the energy required to work the air pump, circulating pump and fans for the cooling tower costs more than the saving made by condensing. In other words, in this station it would pay to exhaust to atmosphere. The engines are of a very high-class make, with Corliss valves guaranteeed to use under twenty pounds of steam per kilowatt-hour, and yet the whole station is taking nearly forty pounds. It is clear, therefore, that the condensing arrangements and auxiliaries require overhauling, and no doubt there are many stations which would do with a thorough overhaul by an expert mechanical engineer. Chief engineers of electric power plants are usually electrical men who overlook the smaller mechanical details."

This would seem to indicate a most lamentable state of affairs. If it is true, which is doubtful under the circumstances quoted above, that the engines are really high-class, then the installation of the plant and the design of the auxiliaries must be very far from "high-class." Condensation may be not worth while with certain kinds of high-speed single-acting engines, but with Corliss engines properly designed and installed there should be no question of the advisability of condensation. If the exhaust steam were used to operate a low-pressure turbine or if it were sold for heating purposes, no doubt a considerable economy would accrue, but that is another matter. Even with the existing installation, condensation should pay, if properly carried out. And why should an electrician, knowing nothing of steam-engine practice, be put in complete charge of a steam-driven plant?

ART IN PUBLIC LIGHTING.

While public lighting is no longer the chief source of revenue to central stations, it is a very important feature for many reasons, the chief one being its ever-ready answer to the query, "Are you giving the best service that can be obtained?" Cities that have good street lighting as a rule have good central-station service.

Now, good street lighting is a broad term, and it surely does, and should, include fixtures whose appearence is a welcome addition to a city's streets. That we have much to learn from Europe in this respect would seem evident from the article in this issue by Mr. H. Thurston Owens on "Street Lighting Abroad," but that we can and will accomplish results in every way comparable with the older cities of Europe, goes without saying. It is only a question of time, and that time should be short, for the best interest of all concerned.

The Boston Electrical Show.

As has been previously announced in these columns, the first electrical exposition to be given in Boston, will be held in the Mechanics' Building, November 15 to 25, inclusive. The interest taken in it by the large manufacturers of electrical appliances throughout the country is doubtless due to several causes. It will be the first comprehensive exhibit of electrical appurtenances ever held in the New England states. Owing to extensive advertising, the show will interest not only the general public that is usually attracted by things electrical, but the electric-light and power companies throughout New England, who are expected to send many representatives to see the latest electrical developments. This is of particular interest to the manufacturers, as it will enable them to reach at small expense a large number of prospective customers.

The association which is giving the exposition is a co-operative one, since it is composed of the exhibitors. These have joined the association on the payment of a merely nominal fee, and in the event of a successful show, for which all indications are favorable, the profits will be distributed in the shape of rebates pro rata on the amount of space subscribed for.

The arrangements are practically completed for a harmonious general decorative scheme. The exhibits are being rapidly installed and everything points to complete readiness when the show will open next Monday. The management of the show is in the hands of Chester I. Campbell, 5 Park Square, Boston. The admission fee has been placed at twenty-five cents, and it is believed that Mechanics' Building will see some enormous crowds of visitors within the next twelve days.

Chicago Electric Club.

A very interesting address was delivered Wednesday, November 3, following the regular weekly luncheon of the Chicago Electric Club, by Dean P. B. Woodworth, of Lewis Institute, Chicago. The co-operative forces which were recently established at the University of Cincinnati, Cincinnati, Ohio, have attracted the attention of educators and manufacturing concerns over the entire country. The courses are so planned that the students taking them work alternate weeks in the engineering college at the university and at the manufacturing shops of the city. Professor Woodworth is now engaged in establishing a similar plan in connection with Lewis Institute, and this work was made the subject of his address.

In introducing this subject, Professor Woodworth explained that this educational scheme has been in progress since last January, but owing to the uncertainty as to the results, no efforts were made to attract attention to it. The apprentice system, as developed in combination with Lewis Institute, is a modification of the system now being successfully operated in Cincinnati. Regarding the details, the speaker said substantially as follows:

When the scheme was inaugurated various manufacturers were approached and requested to nominate two or four boys to alternate between the Institute and the shops. In the case where two boys are nominated, one boy was to be at school a week while the other is at work. Several companies responded and a class of forty-seven was started.

The subjects studied are so arranged that the morning periods are devoted to such subjects as physics, mathematics and English, and the afternoons are generally devoted to shop and laboratory practice, thus accomplishing much in a day without overtaxing the minds of the students. Students in these courses attend throughout the entire year, thus averaging approximately the same number of hours as the regular students. The matter of co-operation of the instructors has much to do with the rapid advancement of the students. For instance, if a class carries out an experiment in the physical laboratory, the mathematics instructor acquaints himself with the nature of the experiment and during the mathematics period instructs the class in the mathematical phase of the experiment. In the same way the instructor of English requires the class to write an essay on the experiment. In this way each day is a complete unit.

Figures presented by Professor Woodworth, giving the results up to the present time, show that the scheme will undoubtedly be successful. While out of the forty-seven pupils who started only twenty-four still remain, those who have left have given reasons which do not in any way affect the feasibility of the scheme. The ages of the students average from sixteen to twenty years, and there are students whose previous schooling was very limited, and others who are graduates of high schools. When starting, each pupil receives ten dollars per month from the manufacturer, which amount is increased as the efficiency of the young man increases.

In concluding, Professor Woodworth stated that since the experimental stage of this scheme has been successfully passed, the Institute will give it publicity, and he believes that much good will be derived therefrom. It is encouraging to the officials of the Institute to note how interested these apprentice students are in the work, and in several instances they have advanced quickly and become more efficient than the regular students.

The Traction Situation in Detroit.

On Monday last, November 8, in Detroit, Mich., Mayor Philip Breitmeyer turned over to the Common Council Franchise Committee and the Citizens' Committee of Fifty (which is endeavoring to work out a settlement of the traction question) the appraisal of the property of the Detroit United Railway, made by Engineer F. T. Barcroft. It places the total valuation of the company's holdings in Detroit at $11,284,606. There also is property valued at $1,550,000, which is excluded from the appraisal, such as unused real estate, pavements, etc. The company has a total mileage in the city, exclusive of extensive suburban lines, of 170.41, and operates 998 cars.

An appraisal of the company's physical property by an engineer employed by the company fixed the total value at $24,708,375. Franchises on sixty-six miles of the company's trunk lines expire on November 14.

"Readiness-to-Serve" Rates Approved in Wisconsin.

The Railroad Commission of Wisconsin, in rendering its decision of the settlement of rates for the city of Marinette, Wis., said: "Electricity should be considered a service rather than a commodity. It is not fair that a consumer who uses ten kilowatts for ten hours per day should pay as much as one who uses 100 kilowatts, but uses it all in one hour."

This opinion was not handed down by the commission until it had made a very thorough and exhaustive investigation which, it is understood, covered a period of about six months. This opinion practically orders the cities of Wisconsin to adopt the "readiness-to-serve" rate basis. —From a paper on "Lighting Rates in Towns of Over 15,000 Population," by N. G. Linn, of Bloomington, Ill., read before the recent convention of the Illinois State Electric Association.

Japanese Commissioners at Pittsburg.

Friday, November 5, was a strenuous day, and yet one of the most interesting, in the itinerary of the Honorary Commercial Commissioners of Japan, who are now making a tour of this country. The day was spent in visits to the great industrial plants around Pittsburg. Practically all the morning was required to inspect the famous mills of the Carnegie Steel Company at Homestead, Pa. The visitors and their escorting committee were the guests of the Carnegie Steel Company at an informal luncheon at these works.

Early in the afternoon a special train carried the party to East Pittsburg, where the shops of the Westinghouse Machine Company were first visited. Here was observed the construction, assembling and testing of steam turbines, gas engines, steam engines and condensers.

The visitors were then escorted to the works of the Westinghouse Electric and Manufacturing Company, where a number of Japanese guides took them in charge and showed them through the numerous departments of this great establishment. Besides observing the manufacture and testing of generators, motors, transformers and other auxiliary apparatus of all types and sizes, considerable attention was directed to the large electric locomotives being built for the New York terminals of the Pennsylvania Railroad.

A trip was then made by special train to the works of the Westinghouse Air Brake Company at Wilmerding. During the inspection of these shops the visitors witnessed a demonstration of how the air brakes are applied on a train of fifty to 100 cars.

From Wilmerding a group of the leading Japanese visitors was taken to East Liberty as the special guests of a number of officers of the Westinghouse companies, who gave a dinner in their honor at the Rittenhouse. Covers were laid for thirty, among whom were the following specially honored Japanese guests:

Baron E. Shibusawa, chairman of the commission, president First Bank.

Mr. Buei Nakano, member of the House of Representatives, president of Tokio Stock Exchange and Tokio Chamber of Commerce, director of Tokio Electric Railway Company, Limited.

Mr. Michio Doi, president of Osaka Chamber of Commerce, Osaka Electric Light Company, Limited, and Naniwa Electric Railway Company, Limited, director of Osaka Godo Cotton Spinning Company, Limited, and Ujikawa Hydrielectricity, Limited.

Mr. Jihei Nishimura, president of Kyoto Chamber of Commerce, director of Kyoto Shoko Ginko and Kyoto Textile Fabric Company, Limited, member of House of Representatives.

Mr. Kahei Otani, director of Yokohama Water Works Bureau, president of Yokohama Seventy-fourth Bank, and Japan Tea Manufacturing Company, Limited, director of Yokohama Electric Wire Company, Limited, member of Yokohama Chamber of Commerce.

Mr. Tominosuke Katono, managing director of Meiji Ginko and Nippon Cars Manufacturing Company, Limited, director of Nagoya Electric Power Company, member of Nagoya Chamber of Commerce.

Mr. Heizaemon Hibiya, president of Kanegafuchi Cotton Spinning Company, Limited, director of Fuji Gassed Cotton Spinning Company, Limited, and Tokio Woolen Textile Company, Limited.

Mr. Sakutaro Satake, president of Tokio Electric Light Company, Limited, and Tenth Bank, Kofu, director of Kabuto Beer Brewery, Limited.

Mr. Kaichiro Nezu, member of House of Representatives and Tokio Chamber of Commerce, director of Tobu Railway Company, Limited.

Dr. Riuta Hara, doctor of engineering, engineer of Yokohama Water Works Bureau.

Mr. Narazo Takatsuji, director and chief engineer of Kanegafuchi Cotton Spinning Company, Limited.

Mr. W. M. Zumoto, editor and proprietor, *Japan Times*.

Consul-General K. Midzuno.

After partaking of the fine dinner thus provided, a number of brief but appropriate addresses were made. The success of this dinner was due to the excellent arrangements that had been made by W. M. McFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company, who was also toastmaster, and whose personal greeting to each guest was greatly appreciated.

Mr. Howe Talks on Factory Lighting at Grand Rapids.

The Grand Rapids-Muskegon Power Company, Grand Rapids, Mich., entertained over two hundred manufacturers at a dinner given at the Pantlind Hotel on Wednesday evening, November 4, which was followed by an address and demonstration on factory lighting by C. A. Howe, manager of the Chicago office of the Holophane Company. Many of the city's manufacturing companies were represented, as well as manufacturers from the nearby cities of Lowell, Belding, Kalamazoo, Muskegon, Coopersville and Grandville.

One of the objects of this meeting was to stimulate good feeling between the representatives of the power company and the representatives of the manufacturers. The power company, therefore, had about twenty-five of its different heads of departments present, while many of the guests were superintendents of factories and engineers. In addition, a goodly number of factory proprietors accepted the invitation sent them and were present.

The banquet hall was artistically decorated and presented some novel features in illumination. The table decorations were intermingled with miniature lamps which burned independently of portable table lamps placed at short intervals around the table. After the first course of the dinner the lights were turned off and the large manufacturers' monogram, "G-R-M," standing for Grand Rapids Manufacturers, was switched on. The incandescent lamps were so arranged that at times only carbon lamps were used and then tungsten lamps were lighted, showing a marked contrast between the two illuminants. Another novel lighting effect was produced by several mercury arc lamps, which, when lighted, afforded much amusement.

H. W. Hillman, manager of the Grand Rapids-Muskegon Power Company, gave a brief history of lighting, starting with the candle, and relating the rapid advancement of the various illuminants up to the present tungsten lamp.

Following this brief introduction, Mr. Hillman introduced Mr. Howe, who discussed factory lighting in a very practical manner, void of technicalities, and illustrated his talk by means of various lighting appliances. He said that there is no set rule for factory lighting, as each factory must be arranged according to its needs, and if properly engineered, the lights can be very easily controlled and directed. To illustrate the progress of illuminants, Mr. Howe lighted a number of carbon lamps which he said consumed 2,788 watts. This illumination he compared with an equal number of tungsten lamps which gave better light at a consumption of only 960 watts. He exhibited and explained various shades and reflectors, particularly the new angle reflectors, showing how the rays of light can be diffused or concentrated as desired to meet any need.

In conclusion, Mr. Howe said the power company favored the tungsten lamp, which used much less current than the carbon lamp, because it appreciated the value of a satisfied customer.

Following Mr. Howe's address, the manufacturers inspected the different lamps, shades and reflectors exhibited.

Fifth Annual Meeting of the Western Association of Electrical Inspectors.

The fifth annual meeting of the Western Association of Electrical Inspectors was held at the Employers' Association Hall, Stevens Building, Detroit, Mich., October 26 to 28. The programme followed at this meeting included the reading of several interesting papers, reports of various committees and tours of inspection of the various electrical industries in Detroit.

The first meeting was called to order at 10 o'clock Tuesday morning by Vice-President Frank R. Daniel, who presided on account of the illness of President George D. Boyle. The report of Secretary W. S. Boyd was read and showed the association to have made a nominal gain in membership. Various new business was brought up, which was followed by the report of the committee on "Uniformity of Rulings," and later the reports of the committees on "Grounding of Conductors for Safety" and "Public Safety."

Tuesday evening the members of the association attended an informal dinner and were entertained by James E. Cole, commissioner of wires, Boston, Mass., who addressed the delegates on the subject of "Municipal Control of the Electrical Hazard." Mr. Cole's address related principally to the past and present conditions of electrical wiring in Boston, and to methods of preventing the large number of fires in Boston caused by defective wiring.

Wednesday morning was devoted to a number of inspection tours. The afternoon session was opened by the reading of a paper by Alexander Henderson, of the American Circular Loom Company, entitled "The Effect of Inspection on the Manufacture of Electrical Appliances." Mr. Henderson's paper emphasized the benefits the manufacturers derived from having electrical appliances standardized.

This paper was followed by an address by J. B. McCarthy, president of the Electrocraft Publishing Company, on the subject of "The Technical Press and Its Relation to Electrical Inspection Work." Mr. McCarthy appealed to the electrical inspectors to co-operate with the technical journals in the matter of publicity of their findings, so as to keep the electrical field informed of proper and approved appliances and installations.

The discussion of metal molding, which followed Mr. McCarthy's address, was led by R. L. Daniel, of the General Inspection Company, Minneapolis, Minn., and was entered into by a number of the delegates. The discussion resolved itself into an experience meeting, and its object was principally to emphasize the points in favor of metal molding so that it will eventually become generally used.

Following this discussion, another was entered into on illuminating engineering. This discussion was led by H. C. Harris, of the General Electric Company, and was also participated in by a number of the members. It related principally to the difficulties encountered in electric-wiring installations in damp places, numerous experiences being given, and several valuable suggestions made. The Wednesday session was concluded by a brief discussion on the difficulties arising in electrical inspection work.

The inspection tours were continued on Thursday, the delegates visiting the plants of the Detroit Fuse and Wire Company, Detroit Insulated Wire Company, American Heating Company, and the American District Telegraph Company. The afternoon session was opened by a report of the committee on architects' specifications. The report of this committee was listened to with interest, as it was the opinion of some of the inspectors that standard sets of specifications could be drawn up and followed by architects in their plans. The question was left to this committee, which reported that it was impossible to draw up a standard set of specifications which would apply to all buildings.

Following this report, the report of the committee on instructions to the public concerning the safe operation and maintenance of electric wiring, was read. This report was a series of "don'ts" written in such language as to be understood by the public at large. The report of the committee on installations and operation of induction motors recommended that larger wire be used in the installations of these machines. The reports of the committees on construction and installation of electric signs and show-window and display lighting were read by the respective chairmen and following brief discussions were adopted by the association. Following the various reports, a discussion of the inspection tours taken by the members was participated in by many members who had made notes on the different subjects they thought worthy of discussion.

For the ensuing year the following officers were then elected: Fred G. Dustin, Minneapolis, Minn., president; W. J. Gilsdorf, Lexington, Ky., first vice-president; H. G. Young, Streator, Ill., second vice-president, and Wm. S. Boyd, Chicago, Ill., re-elected secretary and treasurer. Omaha, Neb., was decided upon as the place for the next annual meeting, which will be held in October, 1910, the days to be decided upon later.

In addition to the inspection of various electrical plants, the delegates inspected a theatre equipped with auxiliary emergency lamps supplied with current from a storage-battery station. They were also taken on an enjoyable river excursion and visited Livingston Cut. En route the party stopped on the Canadian side for luncheon, and before returning visited the Del Ray plant of the Detroit Edison Company.

Joint Pole Lines in New York City.

Commissioner O'Brien, of the Department of Water Supply, Gas and Electricity, city of New York, which includes the electrical inspection service of the city, has announced the withdrawal of a rule relating to joint use of pole lines, which appears on page 21 of the printed electrical rules of the department, and reads:

"25. Conductors must not be placed upon fixtures erected or maintained for supporting wires of another class, except at crossings when approved by said department."

For the above rule the following has been substituted:

"25. a. Electric light and power wires must not be placed on the same cross-arm with telegraph, telephone or similar wires, and when placed on the same pole with such wires the distance between the two inside pins of each cross-arm must not be less than twenty-six inches.

"b. Electric light and power wires must not be placed on the same pole with telegraph, telephone or similar wires unless the former are placed above the latter and separated therefrom by a vertical distance of at least four feet, and where the voltage does not exceed the following normal operating values:

Constant-potential metallic circuits..... .....5,000 volts
Alternating-current series circuits..... .....5,000 volts
Direct-current series circuits....7,500 volts
Direct-current railway circuits... 700 volts

"c. In the event of electric light or power wires passing down a pole carrying signal wires, the former must be enclosed in a grounded metallic covering and be suitably protected against mechanical injury, from the lowest electric-light cross-arm to the ground or to a point three feet from the center of the pole, measured horizontally.

"d. Mast arms and other conducting fixtures or rigging located below the lowest electric-light and power cross-arm must be grounded. Transformer cases must be grounded unless the secondary circuits are grounded.

"e. Mast arms, etc., transformers with ungrounded secondaries, and shields for conductors running down the pole must be grounded at the pole to which they are attached, and messenger cables for elec-

tric light and power must be grounded at least every five hundred feet, either by independent ground wires or by bonding to ground wires already in place.

"f. Transformers must not extend below and cable boxes must not extend above their respective cross-arms, unless the distance between the two groups of cross-arms be suitably increased."

Engineers Lacombe, Sever and Wynkoop, who have given the subject much attention in Brooklyn during the past four or five years and in Manhattan and the Bronx since the reorganization of a year ago, submitted the following report in connection with the recommendation for a change in the rule, which the commissioner has accepted:

The old rule, the abandonment of which we are recommending, has been inherited from the Board of Electrical Control and was undoubtedly appropriate to the wire conditions and to the state of the art at the time of its adoption. With the infinitely better construction which finds favor today and with the gradual reduction of wire congestion on our principal highways, it is believed to be good policy to restrict the number of poles by requiring that all overhead conductors erected on any street be carried, so far as practicable, on one line of poles. It is believed also to be sound engineering to support upon one series of poles conductors for signaling and those for electric light and power, provided, first, that the signal wires, which are the less substantial, be placed underneath so that they may fall away from rather than upon the electric light and power wires; and second, that the voltage of the electric light and power circuits be limited to the value which the consensus of electrical opinion throughout the country endorses for this situation.

The policy of requiring grounded metallic coverings for wires carrying dangerous potentials when brought down within reach of the public or even within reach of the signal linemen has met with some objections either technical or financial—at the hands of the various electric companies in this city, but these alleged obstacles are not insurmountable, and, therefore, we believe should carry no weight where human life lies in the other side of the balance.

At the meeting of Franklin Institute, Philadelphia, Pa., that was held on the evening of November 11, Jacob S. Goldbaum, of the University of Pennsylvania, delivered an illustrated lecture on "Advances in Electro-Analysis."

Annual Meeting, American Trade Press Association.

The annual meeting of the American Trade Press Association was held at the Hardware Club, 253 Broadway, New York city, on Friday evening, November 5. This was the twentieth anniversary of the association, and seventy-three members and guests sat down to the annual dinner. The gathering was found to be an unusually pleasant one by all who attended.

No set papers were read or discussed at this meeting, it being given over largely to retrospect covering the past history of the association and forecast for the future. The strength and influence of the association, which is composed of the most representative trade journals of the country, has steadily grown, as is evident from the membership and the length of the annual reports; the fourth annual report covered four pages, the nineteenth 151 pages.

The following officers were elected for the ensuing year:

President, John Clyde Oswald, of the *American Printer.*

First vice-president, Emerson P. Harris, of *Advertising and Selling.*

Second vice-president, E. A. Simmons, of the *Railroad Age Gazette.*

Third vice-president, H. M. Swetland, of *The Automobile.*

Director to serve four years, Franklin Webster, of the *Insurance Press.*

Secretary and treasurer, L. J. Montgomery, 280 Broadway, New York.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of schedules, being careful to give the schedule number. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening.	Article.	Quantity.	Delivery at Navy Yard.	Schedule.
November 16, 1909..	Cable, night signal	Miscellaneous	Various	1870
	Cable, interior communication	"	"	1870
	Conductor, silk, double	"	"	1870
	Conductor, silicon bronze	"	"	1870
	Conductor, double, plain	"	"	1870
	Conductor, twin	"	"	1870
	Conductor, single	"	"	1870
	Card, telephone	"	"	1870
	Globes, type "F"	2,000	Norfolk, Va	1875
	Strips, front door, searchlight	Miscellaneous	Various	1870
	Tape, insulating, cotton	600 pounds	Norfolk, Va	1875
	Wire, silicon bronze	30,000 feet	Brooklyn, N. Y.	1870
	Wire, platinum, silver coated	300 feet	" "	1870
	Wire, bell	Miscellaneous	Various	1870
	Wire, magnet	"	"	1870
	Wire, resistance	"	"	1870
	Wire, telephone	30,000 feet	Brooklyn, N. Y.	1873
	Wire, rubber-covered	68,500 feet	" "	1873
	Wire, telephone	10,000 feet	" "	1894
November 23, 1909..	Generating sets, turbo and motor	Two turboes and one motor	Factory	1903

Lewis Institute Branch, American Institute of Electrical Engineers.

The beginning of the third year of active work of the Lewis Institute Branch of the American Institute of Electrical Engineers was marked by the meeting held on November 3 in the auditorium of Lewis Institute, Chicago. The meeting was a distinct success, being attended by nearly four hundred engineering students. The speaker of the evening, Alex. D. Bailey, of the Commonwealth Edison Company, gave an interesting talk on "Central-Station Operation in Chicago." He spoke of the rapid development of central stations throughout the country, and especially the growth of central-station service in Chicago. The Fisk Street and Quarry Street stations were cited as examples of the most modern central stations extant, and some interesting figures concerning their operation were given.

The boiler rooms of these two stations contain 104 boilers with a total heating surface of nearly fourteen acres, capable of evaporating over 2,500,000 pounds of water per hour, and converting it into steam at 200 pounds pressure and 150 degrees superheat. This requires nearly fifty carloads of coal per day. The coal used is commonly known as Illinois screenings. It is taken from the cars and conveyed to the bunkers over the boilers, whence it is fed into the furnaces by means of mechanical chain-grate stokers. The ash drops from the end of the grate and is taken away in the outgoing cars.

The turbine rooms contain thirteen turbo-generators of a total capacity of 215,800 horsepower. Each turbine comprises a complete station in itself, having its own set of boilers, condensing system, coal-handling machinery, and boiler-feed piping, thus carrying out the unit system to the minutest detail. Each unit is in this way entirely isolated from and is an exact duplicate of every other unit, which greatly facilitates the operation of the station and minimizes the danger of mistakes and accident.

The current is generated at 9,000 volts and twenty-five cycles and passes directly to the switch house. The operation of the switches in the latter is carried on from the operating gallery in the turbine room with the remote-control system. Therefore no pressure exists on the operating board over 110 volts.

From the switch house, the current is transmitted to the various substations of the system for distribution to the thousands of consumers.

A New Method of Instantaneous Roentgen-Photography.

It is well known in technical circles that the Roentgen method, though fourteen years have passed since its discovery, is still not appreciated by a sufficiently large number of physicians. The reason for this is the complicated technics of the method, on one hand, and also the fact that the quality of the radiograms leaves much to be desired. The time of exposure at present necessary is much too long, for it is known that the thorax of a human being partakes of the vibration caused by the blood circulation, and radiograms of the same produced by long exposure will therefore not faithfully reproduce its structure. A new process invented by Engineer F. Dessauer seems likely to bring about a revolution in this field. He departs from the method of producing strong induction impulses and does not employ the usual alternating-current transformer and interrupter, but uses a single induction impulse of extraordinary intensity. The simplified apparatus consists of only two elements—a particularly large induction coil capable of withstanding extraordinary loads for a short time, and an explosive "cartridge" connected across the capacity. The inertia of the interrupter is thus eliminated and the discharge takes place automatically. The cartridge consists of a thin silver or copper wire, which is fused at the moment when the current intensity has attained the desired value. The suddenness of its destruction is increased by additions to the mass covering the wire. The photographic process is extremely simple and requires only the operation of a switch. The explosion of the cartridge causes the interruption of the primary circuit with unusual suddenness and an induction impulse of extraordinary intensity follows. A spark forty centimetres in length is sufficient for a radiogram of any part of the body, and the entire time of exposure varies from one-fiftieth to one-one-hundred-and-twentieth of a second at a secondary load of about 260 milliamperes. It is thus possible to make from forty to fifty exposures in an hour; the wear on the tubes is reduced to a minimum, and the entire process is highly economical. It also brings us closer to the realization of cinematographic photography of the heart and the functions of other parts of the body, and thus opens up many still unknown fields. —*Abstracted from Elektrotechnischer Anzeiger (Berlin), September 30.*

Electrical Exports for September.

A summary of the electrical exports from the United States for the month of September has just been completed by the Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C. The totals shown below indicate a healthy improvement over the figures both for the preceding month and the corresponding month last year. The exports of electrical appliances (including electrical instruments and apparatus for scientific purposes, telegraph and telephone instruments) during September were the heaviest shipments for any month for nearly two years. This fact more than counterbalanced the reduction in exports of electrical machinery as compared with September, 1908. The total shipments of electrical appliances for the nine months of this year show that the 1909 total will come pretty near the heavy total of 1907. In electrical machinery, however, there continues a steady falling off from the record totals of 1906 and 1907.

The comparative monthly totals are as follows:

	Sept., 1909.	Sept., 1908.	Aug., 1909.
Electrical appliances.	$ 686,049	$430,785	$ 590,864
Electrical machinery.	480,835	568,525	448,976
Total	$1,166,884	$999,310	$1,039,840

The principal countries to which electrical products were shipped from the United States during last September, with the values of these exports, are as follows:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$ 56,852	$46,912
Belgium	8,454	.....
France	2,697	7,511
Germany	10,595	2,826
Other Europe	5,543	54,820
British North America	200,336	37,220
Central American States and British Honduras	37,691	8,697
Mexico	90,471	90,039
Cuba	18,606	8,252
Other West Indies and Bermuda	7,355	225
Argentina	20,539	14,799
Brazil	151,166	23,206
Other South America	28,456	6,901
British East Indies	.....	1,408
Japan	10,923	89,696
British Australasia	9,105	68,065
Philippine Islands	14,388	200
British Africa	10,025	18,620

Recent Wave-Length Experiments.

In the August number of the *Physical Review* there is given an account of the experiments recently carried out by H. W. Webb and L. E. Woodman at Columbia University on the lengths of the waves emitted by generators of short electric waves.

Boltzmann's method was employed and rod, cylinder, Righi and other generators were tested. It was found that for apparatus of the same type, the wave length is proportional to the linear dimensions of the apparatus.

The Predetermination of Earthquakes.

An Italian physicist, Padre Maccioni, has exhibited before the Academy of Siena an instrument capable of indicating earthquakes at least a few minutes in advance. In the construction of his apparatus Maccioni has been guided by the theory that electromagnetic waves emanate from the source of an earthquake before the occurrences of an actual shock. He employs a suitably arranged detector for recording the electric waves. After many unsuccessful experiments he was led to the construction of a special form of coherer which responds to all wavelengths and in which the quantity of iron filings between the end cylinders varies according to the distance between the coherer and air gap. The alarm apparatus consists of a small battery, in the circuit of which a sensitive galvanometer relay and the new coherer are connected. One of the poles of the coherer is joined by a wire to a metal plate buried vertically in the ground. The relay serves for closing the circuit of a strong galvanic element containing a writing instrument, a clock arrested at twelve and an alarm bell. The time elapsing between the arrival of the electrical and the arrival of the mechanical waves is determined from the time indicated by the alarm arrangement and that shown by a sensitive seismograph. Last April Maccioni was able to predict by the aid of this apparatus two earthquake shocks which occurred at a distance of twenty-two kilometres from the observatory, four minutes in advance.—*Abstracted from Die Umschau (Frankfort a. M.), October 9.*

Electrical Development in Uruguay.

From Montevideo, Consul F. W. Goding reports that an offer has been made to the Interior Department of Uruguay by a French concern to establish electric power houses in the interior which will supply light and power to the inland towns.

The enterprise binds itself to furnish apparatus, light and energy to the state, as well as to the citizens, at a price at least equal to the lowest price now paid in any of the towns. The concession is asked for twenty-five years, after which time the power houses, kept in perfect condition, will become the property of the state. The sum to be employed in the first installations, in the eighteen towns not now provided with plants, will be 500,000 pesos ($517,000), and the work will be completed within eighteen months after the concession has been granted.

Western Permits for Waterpower.

Evidence tending to confirm the report that the past seven or eight years has witnessed a general demand throughout the West for power sites is contained in a statement prepared by the interior department at Washington, D. C., showing that 244 permits have been issued to date under the act of February 15, 1901. The fact that each and every one represents a revocable easement emphasizes to what extent corporations are going in order to develop waterpower in that section of the country.

The following schedule by states shows the number of permits issued by the interior department under the act of February 15, 1901, to date:

Arizona, 45; California, 87; Colorado, 43; Idaho, 12; Montana, 14; Nevada, 18; New Mexico, 7; Oregon, 7; South Dakota, 2; Utah, 2; Washington, 5; Wyoming, 2.

Of the above 244 permits eighty-seven are for lands in forest reserves. All are said to be for reservoirs, canals, pipe, and transmission lines and power sites to be used for the purpose of generating and transmitting electric power. Of the permits granted forty-four have been revoked principally in Arizona, California and Colorado because in forest reserves and for non-construction.

The New Haven's Developments.

A recent dispatch from New York states that the acquisition by the New York, New Haven & Hartford Railroad Company of new trolley interests in Westchester County, N. Y., together with its plan of extending its New York and Westchester line northward in that county, are believed in New York railroad circles to forecast an important ultimate railroad plan.

By its New York and Westchester line through the Bronx, the New Haven will ere long acquire by subways a new entrance into New York, which, to some extent, will divert business from the Grand Central terminal. On the other hand, from the upper end of its Westchester extension only a small gap will remain to be spanned to connect with the New Haven system at or not far from Brewsters Station.

With that connection made, along with its new entrance into New York, the New Haven company would have an additional line into New England which can be used for freight, and to a much less extent passenger business, and, what is of greater importance, a close connection with its Poughkeepsie bridge system and its Ontario and Western line for western and coal business. This, it is believed, is one of the most significant features of the New Haven's terminal work at New York and its Westchester extension.

Brooklyn Subway Contract Signed.

A contract was recently signed between the city of Brooklyn and the Tidewater Building Company and Thomas E. Bryson for the construction of the fifth section of the (Brooklyn) Fourth Avenue subway. Work will accordingly be begun immediately on this section, which covers that part of the subway running under Fourth Avenue from Tenth Street to Twenty-seventh Street. The price for the railroad proper is $1,945,640, and for the pipe galleries $251,076.

This makes the third section of the Fourth Avenue subway for which the contracts have been signed. Two sections were let to William Bradley and extend from Willoughby Street to Ashland Place, and from Ashland Place to Sackett Street.

There remain to be signed contracts for three more sections; the first section, from Nassau to Willoughby Street, for which James P. Graham was the successful bidder; the fourth section, from Sackett Street to Tenth Street, and the sixth section, from Twenty-seventh Street to Forty-third Street, the contracts for both of which were awarded to the E. E. Smith Contracting Company, of Philadelphia.

The Utilization of Coal Dust.

The burning of coal dust can be accomplished under much better conditions than that of coal in lumps, for the quantity of air necessary for its combustion can be exactly regulated and high temperatures thus obtained. Coal dust has an advantage over gas in that the loss of heat in the gas generator is avoided. Very long flames—eighteen metres in length, for instance—may be obtained by its use. The coal dust is introduced into the furnace by injectors similar in form to the water injectors on steam boilers. More or less compressed air is sent through tubes provided with nozzles into which the coal dust falls. The coal most suitable to be burnt in this manner is that containing much volatile substance, as lignites; but any kind of coal dust otherwise unfit to be burned may be utilized in this way. The most serious objection to the process is the danger of explosion on account of accidental production of an explosive mixture from the air and dust. But this may be prevented by ventilating the localities and washing or dampening the walls by water or steam jets. Ashes rarely cause any inconvenience, as they are carried off with the gases of combustion, and for this reason it is possible to utilize fuel of low value and containing a large proportion of ashes.—*Abstracted from l'Industrie Electrique (Paris), September 30.*

Copper Imports and Exports for September.

Advices from the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., show that the value of the imports of copper in September, 1909, was $1,657,760, as compared with $2,282,468 in September, 1909, and for the nine months ended September, 1909, $21,319,805, as compared with $15,160,211 in the same period of 1908 and $32,514,647 in the same period of 1907.

The value of the copper exported, not including ore, in September, 1909, was $6,770,310, as compared with $6,254,518 in September, 1908, and for the nine months ended September, 1909, $69,413,852, as compared with $70,488,923 in the same period in 1908 and $68,485,954 in 1907.

Human Endurance Decision in Indiana.

Owing to the many complaints of trainmen being required to work long hours on the interurban railways, the Indiana commission has issued a state circular to the railway companies. A number of cases have been reported where trainmen worked more than sixteen consecutive hours, and returned to work with less than eight hours' rest.

While the attorney-general has decided that the sixteen-hour law of 1907 does not apply to interurban roads, the commission instructs the roads that they are amenable to the penalties of the acts and recommends that prompt and efficient steps be taken to limit the hours of service in accordance with the acts. S.

Moving Sidewalk in New York.

The Continuous Transit Company, of New York, has offered to build a moving platform under Broadway, between Fourteenth and Forty-second streets. Chief Engineer Henry B. Seaman of the Public Service Commission, recommends that the routes proposed by the company be laid out, and an early installation of one of them required.

Joint Laboratories at Madison for Forest-Products Investigation.

Preparations have been completed for the transfer of all the government's forest-products work to Madison, Wis., where the United States Forest Service Products Laboratory will be located, and to Chicago, where the headquarters of the office of wood utilization will be established.

The new Forest Products Laboratory being erected at Madison by the University of Wisconsin, which will co-operate with the government in its forest-products work and which is to cost approximately $50,000, is now in the course of construction. The laboratory will be a fireproof building and is expected to be ready for occupancy on January 1. In the meanwhile temporary offices will be located at 1610 Adams Street, Madison.

On October 1 the Yale Timber Testing Laboratory was discontinued and the Forest Service equipment there shipped to Madison. The laboratory at Washington, D. C., was discontinued at the same time. The Timber Testing Laboratory at Purdue, Ind., will be operated until the middle of December, when it will be discontinued and its equipment shipped to Madison.

McGarvey Cline will be director of the Madison laboratory. The work of this laboratory will be assigned to five offices, as follows: Wood preservation, which will study all problems related to the impregnation of wood with preservatives and other substances; wood chemistry, which will handle all work bearing on the chemical utilization of forest products—wood distillation, paper pulp and other fiber products, chemical analyses of creosotes, turpentines, etc., being the principal lines handled by this office; timber tests, which will have charge of all tests to determine the strength and other mechanical properties of different woods; technology, which will study the microscopic structure of wood, methods of seasoning and drying it, and other problems of a purely technical character; maintenance, which will have charge of the filing and computing, also being responsible for the purchase of supplies and general care of the entire laboratory.

The class of work in the laboratory may be separated into three kinds, as follows: (1) The investigation of problems in experimental research. (2) Experimental work in co-operation with commercial plants to verify laboratory experiments on a commercial scale. (3) Co-operation with outside parties for the purpose of assisting them in applying principles and processes of recognized commercial value with which the Service is thoroughly familiar.

The work of the office of wood utilization at Chicago will consist of studies of the wood-using industries of various states, the study of woods in manufacture and of the methods of disposing of mill waste, the collection of statistics on the price of lumber at the mill and at the principal distributing markets of the country, and the study of specifications and grading rules. The office will also secure statistics of forest products of importance to the experimental work of the Service and the study of the movements of lumber and of the conditions of the principal lumber markets. This office will be in charge of H. S. Sackett.

Synchronizing Device for Closed-Circuit Motors.

The employment of three-phase induction motors with closed-circuit rotors,

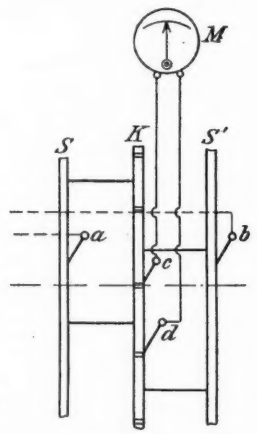


DIAGRAM OF SYNCHRONIZING DEVICE.

when such machines work under conditions that allow their starting without load and running at constant speed, is preferable to the use of motors with collector rings on account of their simpler and less expensive construction. However, the starting of such motors presents well-known difficulties, which are the greater the more powerful the machine. Very large motors are usually started under no load by small auxiliary motors. In order to connect the three-phase motor to the line conductors its speed must be as near as possible to synchronism, for the heavy current impulse which otherwise results is injurious to the central station as well as to the motor.

Dr. Felix Horschitz has devised a new and simple arrangement for indicating when the motor is in synchronism. This is shown in the accompanying illustration. Two narrow slip rings S S′ and a narrow commutator K, with as many segments as the motor has poles, are fastened on the shaft of the motor. Brushes *a b*, each connected to one line wire through a low-tension transformer, bear on the slip rings. An ordinary polarized voltmeter with its zero in the center and permitting indications to the right and left, is connected to two other brushes, *c* and *d*, bearing on the commutator in such a way that they are displaced by exactly one segment.

Assuming the motor to be in synchronism, the alternating current sent into the instruments is commutated during one-half period and is not commutated during the next half period. The form of current obtained in the instrument thus depends on the time at which commutation takes place with respect to the original wave. When there is any slip the point of commutation is retarded and the instrument needle begins to oscillate, the more strongly the greater the slip. When a motor is started from a position of rest a slow vibration of the needle will at first be observed. Its movement will become slower and more distinct with increase in speed. At half synchronism the amplitude of vibration becomes zero, and from this moment on it increases until, in the neighborhood of synchronism, the needle moves more slowly and stops entirely when perfect synchronism has been attained.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, September 2.*

The American Society of Mechanical Engineers.

Among the forthcoming meetings announced by the American Society of Mechanical Engineers is one to be held in Boston on Wednesday evening, November 17 next, which will be devoted to a topical discussion on Low-Pressure Steam Turbines. The speakers will include W. L. R. Emmet, of the General Electric Company, Schenectady, N. Y.; H. G. Stott, of the Interborough Rapid Transit Company, New York; Richard H. Rice, of the General Electric Company, West Lynn, Mass., and Prof. E. F. Miller, of the Massachusetts Institute of Technology.

The next annual meeting of the society will be held in the Engineering Societies Building, New York, December 7 to 10. Further particulars will be announced later.

DOMESTIC AND FOREIGN REGISTRATION OF TRADE MARKS.[1]

BY C. D. AND W. R. DAVIS.

The person who first uses in this country any lawful trade mark in connection with goods of a given kind has exclusive right to continue the use of it, and he may prevent all other persons from using the same trade mark on the same kind of goods, or from using any mark which the ordinary buyer would be likely to mistake for that belonging to the first user. If a person who had no right to use it should register it as his own, this fact would confer no right upon him. When it is desired to establish the date at which the use of the mark began the registry of the trade mark in the Patent Office is useful, because it will show that the person who registered the mark was using it at least as early as the date of registration. His opponent, even though he had the same design in use before that time, may have some difficulty in establishing that fact by satisfactory proof.

In a great many foreign countries title and exclusive right to a trade mark depends upon priority of registration, and not upon first adoption and use. Many American firms have discovered this to their great cost. The daily press and trade journals have recently published many instances in which American firms have suffered from a most pernicious form of blackmail in Cuba and Japan, and our consular reports from other foreign countries are full of warnings to American manufacturers to register their trade marks in all foreign countries in which they are doing business. In many of these countries the registration of the marks gives to the registrant absolute title thereto and also gives him the right to have goods bearing such marks seized at the customs house and confiscated.

It should be strongly impressed upon American merchants and manufacturers who are seeking to develop their export trade that their trade marks and trade names should be registered in every country where they are seeking a market for their goods.

In a recent report of the Commissioner of Patents this matter was carefully considered and the following quotation may be of interest:

"The importance of having trade marks protected abroad, and in many countries registration is necessary to protection, has been forcibly impressed upon American manufacturers who, sending their goods into some foreign country, have found the very trade mark which has become valuable to them registered in that country by some citizen of that country who made application for registration for no other purpose than to enable him to demand of the American manufacturer a price for the right to sell goods marked with that trade mark in that country. As in a number of European countries registration of a trade mark is attributive of property in such mark and is granted, not to the first adopter and user of the mark, but to the first applicant for registration, and as in these countries the registrant under the laws there in force can forbid the importation of goods marked with the trade mark registered by him, or even compel the seizure of such goods, it is evident that such registrant has the manufacturer at his mercy so far as trade in that country is concerned."

As an instance of how the scheme has been worked in Germany we quote from a report of Consul-General Frank H. Mason of Berlin:

"It appears necessary to recall the attention of American exporters to a very peculiar provision of the German law for the registration of trade marks, which is not infrequently used to the great and unjust disadvantage of Americans and other foreigners. Under the German statute, any person may register and secure right to any name or other device used as a trade mark which has not previously been registered here by some other firm or person. In other words, the officials before whom the application is brought make no inquiry to ascertain whether the applicant has ever used the proposed trade mark or has any right to it, but simply look over the record to ascertain whether it has been registered in Germany. If not, it is admitted to registration without further inquiry or delay.

"The readiness with which such a practice can be abused is apparent. When, years ago, American bicycles began to be imported into Germany, certain persons interested in blocking the trade got the trade marks of two or three makers registered in their own names, and either obliged the legitimate American owners of the trade marks to buy them off—in other words, to pay a species of blackmail—or to change the marks on all bicycles exported to Germany.

"In a recent case, the trade mark on a special brand of American preserved fruit was registered here by an outsider so that the real owner had to buy from the usurper the right to use his own trade mark in this country.

"This abuse has become so notorious that a leading patent attorney of Berlin, writing in a recent number of the *Technische Rundschau*, says of the law that its effect is to legalize and facilitate the theft of a trade mark.

"The obvious suggestion to all American exporters is that before exporting or seeking to export to Germany any kind of merchandise covered by a well-known name, they should have such name or trade mark duly registered in this country, where all such rights are carefully protected and prosecutions for infringements easy and effective."

This form of blackmail has also been carried on in other European countries.

[1] The above communication from Davis & Davis, patent lawyers, of 220 Broadway, New York, and Washington, D. C., on the necessity of foreign registration of trade marks is of importance to manufacturers.

Independent Telephone Situation.

The case of Herman C. Stifel, of St. Louis, against the Toledo Home Telephone Company has recently got into the courts, both in Toledo and Indianapolis. Mr. Stifel, who is a voting trustee of the Toledo Home Telephone Company, states that the company refused to allow him to examine its books. He asks that the company be enjoined against removing the books from the jurisdiction of the court. Mr. Stifel has also brought a similar suit in Marion County, Ind., asking for an inspection of the books of the New Long-Distance Telephone Company, of Indianapolis.

At the time that James S. Brailey, Jr., president of the Toledo Home Telephone Company, bought controlling interest in the Cuyahoga, United States and other independent telephone companies it was reported that he was allied with the Bell Telephone Company in an attempt to control the telephone situation in the middle states. Mr. Brailey, however, denies any connection with the Bell company. A later report is that the alliance is with the Postal Telegraph Company.

As a measure of protection against any possible telephone monopoly resulting from these deals, there was a meeting held on October 29 at Columbus, Ohio, of more than 100 independent telephone men. A committee has been appointed and authorized to bring proceedings under the anti-trust law if they find that there is evidence of an attempted monopoly.

Electrical Notes From Great Britain.

By Our British Correspondent.

The month of October is always the time for the English engineering and scientific societies to resume their gatherings after the vacation. For some reason or other the Institution of Electrical Engineers (London) reopens later than nearly all others, and after its own provincial sections have got to work. It also holds weekly instead of fortnightly meetings toward the end of the session, and sits on into May. From programmes that have come to hand it is possible to see what are some of the principal subjects coming forward this winter. At the Glasgow section, after the inaugural address of the chairman, E. G. Tidd, W. A. Kerr will bring on direct-current boosters and balancers, and later in the session R. M. Neilson will read a paper on "The Most Economical Vacuum for Turbine Power Stations." At the Leeds meeting of the institution, following the presidential address of W. M. Rogerson, there was a paper, on October 27, on "Notes on Superheated Steam," by A. B. Mountain. Other subjects arranged for are experiments on single and stranded fuses, the possible beneficial effects of metallic-filament lamps on supply undertakings, equitable charges for tramway supply, notes on overhead lines, and electrical machinery for iron and steel works. The Manchester section commenced on October 22 with an address by S. J. Watson, the chairman. Manchester has a progressive students' section and has arranged a good programme, in which are included the testing of electrical machinery, electric cranes, direct current versus alternating current for railway traction, high-tension spark discharge in air, faceplate-type starters and control apparatus, commercial side of the electrical industry, a modern telephone exchange, and the application of the cradle dynamometer to the testing of electrical machinery. This section is also going to have a joint meeting with the Junior Gas Association of the Manchester district to debate the question of "Gas Versus Electricity for Heating and Power Purposes." This is a capital idea. Gas and electrical engineers in England seldom meet, save in combat in the press or on consumers' light and power bills. Perhaps the rising generation of engineers in both departments will, by meeting in friendly debate, come to see the wisdom of more of a co-operative spirit than of a mutually handicapping rivalry.

Mr. Mountain's paper at Leeds on "Superheated Steam" dealt with the following points: The method of superheating steam by separately fired superheaters and other types of superheaters; practical limits of superheat; the advantages of increased evaporation of boilers, increased efficiency of engines, reduced losses in piping, etc.; the danger of applying superheated steam to engines which have not been specially designed; and lubrication (the difficulty of selecting suitable oil, testing the same, and methods of feeding).

The presidential address of W. N. Twelvetrees to the London Civil and Mechanical Engineers' Society advocated, among other things, an effective union of engineering organizations in England, different institutions continuing their separate existence but entering into bonds of union one with another for the purpose of furthering the good work conducted by all. At the Society of Engineers (London) an evening has been devoted to a prize paper by G. Allan Thomas on "The Status of the Engineering Profession." Mr. Thomas mentioned the chief hindrances to the advancement of the profession, and proceeded to advocate the election of a central organizing body from members of the three most important institutions—the Civil, Mechanical and Electrical Engineers, respectively—which body should endeavor to obtain recognition as a legalized corporation by act of Parliament, and should have supreme organizing and judicial powers in all matters relating to the profession. They should also devote attention to registration, education, minimum fees, organizing funds to aid invention and research.

Prof. W. E. Dalby, in concluding a paper before the Institution of Mechanical Engineers (London) on "Heat Transmission," made certain recommendations. He said that considering the mass of work which had already been done, the century of accumulated practical experience in the design, construction and working of steam boilers, the numbers of able engineers who have devoted their attention to boiler construction and design, and the distinguished men who today control and influence the industry, "it would almost seem that present practice represents the survival of the fittest, and that there is hardly a necessity for further research." But recent years, he added, have been fruitful in researches in other directions, and Professor Callendar, by his brilliant work in platinum thermometry, has placed at the disposal of engineers a practical way of measuring temperatures unknown to early experimenters. We have now a means of accurately measuring the temperatures at different parts of a boiler directly. Professor Dalby therefore suggested that a research be undertaken in which steam boilers of different types, working under practical conditions, may be made the subject of experiments in which all the elements of their working be measured, together with temperature measurements for the purpose of establishing the temperature gradients at different parts of the heating surface. Although such a research would be costly, he believed it would be well worthy of the institution.

In connection with electrolytic disinfectant installation at Poplar, it has now been decided, owing to the low cost of production of the fluid and its efficiency, to duplicate the plant at a cost of $2,150. Four patent electrolyzers for an output of twenty-five gallons of fluid at a strength of four grammes of chlorine per litre, and two stirring machines; also a 240-volt motor to hang vertically, driving two stirring machines, form part of the new apparatus.

Not long ago it was the fashion in some quarters to argue that small electrical exhibitions were more expense and bother to the manufacturer than they were worth. Sometimes it was grumbled that firms which did not exhibit secured trade as a consequence of the enterprise of others who might not be able to trace direct business as a return. It was thought, too, that the electric supply authorities stood to gain so much from a well-got-up and representative display of illumination and devices, that they ought to bear a larger share of the burden. Really, at bottom the opposition was due to the desire of some parties to run occasional big shows and not to patronize the smaller local ones. But time has proved that there is a useful place for each to fill. Though there is no big scheme, such as that of last year at Manchester, actually on foot at the moment, there are several smaller ones of local character, and there is no doubt whatever that these will do valu-

able educative work among the general public. The East London electrical exhibition, arranged by several municipal authorities conjointly, is in progress at Shoreditch. An exhibition of electrical domestic appliances in another part of London by the municipal authority of Hampstead was particularly strong on the heating and cooking apparatus side, being supported by those interested in nearly every new device that has been introduced in this department.

Fears have been entertained[1] lest the increasing hostility among colliery workers toward electrical installations would give a setback to the use of electricity in mines. The hostility is due to certain accidents that have happened, the precise cause of which has not been ascertained, so that miners fear hidden dangers lurking in the apparatus. The trouble has been to some extent stayed by the decision of the government to have the electricity in mines regulations further considered. Meanwhile prosecutions have been set on foot on behalf of the Home Office calling in question the action of mine officials in allowing alleged defective electric apparatus in the mines, thus creating danger through accidental shock or fire in contravention of the acts of Parliament bearing on the subject. Another case has also been heard lately in which a pit repairer has been awarded $1,000 compensation for injuries received in a Fife colliery. It appeared that he, acting under orders, went to switch on the current for the ventilation of the seam. He did not anticipate danger, and was ignorant of the dangerous character of the gas with which the seam was impregnated. Immediately he started the motor an explosion occurred, precipitating a number of men down the shaft, and severely burning the claimant. He declared that the accident was due to the owners not providing a proper system of ventilation, and they admitted their liability in the matter.

The opening of the London & Brighton Railway Company's single-phase line, of which some particulars have already appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, has had to be deferred until December, owing to certain alteration work being necessary in connection with the signals. There is being brought forward just now a $17,500,000 scheme for an eight-mile electric tube line, extending from Victoria Station, London, out to the Crystal Palace. An accelerated service of electric trains has been introduced on the Hampstead, "Bakerloo" and Piccadilly tube railways. During times of rush traffic the Hampstead runs forty-two trains per hour, the "Bakerloo" forty, and the Piccadilly thirty, including a number of "non-stop" trains.

According to figures just issued by the London County Council, the tramways system of that body consisted in March, 1909, of 85 5-8 miles of electric lines, and forty-two miles of horse lines, the capital expenditure having been about $47,500,000. The year's receipts and expenses for the electric lines were: Total receipts, $7,861,255; working expenses, $4,481,430, leaving a surplus of $3,379,825. From this, interest and other financial charges have to be deducted, leaving $538,000 net balance. As arranged, renewals have to be provided for at the rate of two-thirds of a penny (one-and-one-third cents) per car-mile run, and after this $93,900 remains. This amount has been transferred to the renewals fund, toward the deficiencies of past years. Passengers to the number of 344,705,937 were carried, and 31,962,784 car-miles were run on the electric lines. The operating expenses were 7.48 cents per car-mile run.

A couple of years ago the Bradford Engineering Society appointed a committee of inquiry, consisting of representatives of textile, engineering and electrical interests, to investigate the electric driving of textile factories. The first report of this committee has now been made public. Experiments were carried out to determine the actual cyclical variation occurring in prime movers and electric motors and in the shafting and machinery driven by them. Among the conclusions so far arrived at are the following: (1) That in good installations there is practically no difference in cyclical variation between mechanical and electrical transmission when measured at the end nearest the main drive; (2) that any initial cyclical variation which may exist at the driving end of the shaft is liable to be increased if transmitted through long shafts; this can in many cases be controlled by known methods of destroying synchronous vibrations; (3) that, so far as any irregularity is concerned, excluding breakdowns, electrical transmission will maintain its condition better than mechanical transmission. A further conclusion that we may quote is one stating that electrical transmission is likely to be most efficient under the following circumstances: (1) Where there are long lengths of shaft from which power is not taken off at intermediate points; (2) where machinery is distributed and requires starting and stopping frequently during the day; (3) where machines require to run at various speeds and have those speeds altered during motion; (4) where there are excessive lengths of shafting, making it desirable to separate these into two or more lengths. The relative advantages obtained from taking supply from one's own generating station and from an outside source, are also set out in the report.

ALBERT H. BRIDGE.

London, October 30, 1909.

[1] See editorial on "Electricity in Mines" in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, October 30, 1909, p. 820.

Preservation of Telegraph and Telephone Poles and Railroad Ties.

Millions of feet of timber and finished lumber rot every year in railroad ties, bridges, trestles, piles, farm buildings, fences, poles, and mine props. The lumber-consuming public of the United States pays perhaps thirty to forty million dollars a year to make good these losses.

These great drains are a source of more and more concern each year. Chemists and engineers who have to do with the uses of wood are working unceasingly on the problem of stopping this loss. The United States Forest Service has men who devote their whole time to it, and its importance cannot be overestimated. Millions of dollars are annually saved by preservative treatment of timbers, but much yet remains to be learned.

Wood decay is caused by fungus, a vegetable growth, sometimes so small that it can be seen only with the microscope. Its roots or branches, like minute hairs, force their way into the wood tissues and absorb or eat away the solid parts. The collapse which results is called decay. Timber is artificially preserved by forcing into its cells and pores certain substances which prevent the growth of fungi. As long as this substance is present in sufficient quantity, the germs of decay—the threads and spores of fungus—cannot enter, and the wood is preserved. This often means doubling, and sometimes trebling the life of the timber.

The United States Government considers the investigations of the preservative treatment of timber of such importance that the business of one office of the United States Forest Service, that of Wood Preservation, with new headquarters at Madison, Wis., is given over entirely to the work of experiments, in cooperation with railroad companies and other corporations and individuals, in prolonging the life of railroad ties, mine props, bridge timbers, posts, poles, etc.

Electrical Development in Victoria.[1]

It will be interesting at the start just to glance at the development that is taking place in public-supply undertakings in Victorian towns outside of Melbourne. There have been issued about twenty-one orders-in-council granting powers to municipalities, and in some cases to private enterprises, for the public supply of electricity. Some of the towns concerned boast of populations not greater than about 1,000 inhabitants, and on the basis of this population there are yet about forty-four towns which are likely in the near future to require a supply. Of the twenty-one towns holding orders, Ballarat, Bendigo and Geelong are by far the most important. A system of public supply has been in operation in each of these three places for many years, covering not only lighting, but tramways, in the case of the first-named two, while such are projected in the case of Geelong Progress in the latter town has been very marked, when compared with the anticipated results when the plant was first put into operation about eight years ago. Difficulties in obtaining data from several of the towns prevent a further analysis of the progress of events outside Melbourne.

Taking all the supply undertakings in Victoria, not omitting those in the Melbourne area and including tramways, it is found that a large sum of money has been already invested in plant in connection therewith. The capital expenditure on all these undertakings approximates to about $8,000,000, which has been spent on generating and distributing plant of a capacity of about 16,000 kilowatts, of which about 11,000 kilowatts is installed within the metropolitan area of Melbourne. The gross annual revenue from all these undertakings amounts to about $1,250,000.

Taking those undertakings within the metropolitan area of Melbourne, it is found that, excluding tramways, but including those Government buildings supplied with light by the Railway Department, there are at present connected to the distributing mains of the various undertakings no less than 255,800 sixteen-candlepower lamps or their equivalent. The progress during the last six years has been most pronounced.

So rapidly is the demand for current for power purposes growing that it can only be a matter of time when such demand will be of greater importance than the lighting. This result will, no doubt, be assisted by the introduction of the metal-filament lamp, with its low consumption of current for equivalent light.

As far as electrical tramways development in Melbourne is concerned, there is little progress to report, the only ones in operation being the St. Kilda line, worked by the Railway Department, and the Essendon line, owned by the North Melbourne Tramway and Lighting Company.

In many districts in the Melbourne area no public supply of electricity is yet available, although in some of these, statutory powers have been obtained for giving such a supply. For example, orders-in-council have been granted in the cases of Hawthorne, Williamstown, Footscray, Port Melbourne, Brighton and others, but so far no supply is available. Some of these powers have been lying dormant for many years, and it seems only fair that the bodies to whom such were granted should be forced by the Government to work their orders, or have them canceled. In the latter case there would be, I am sure, no lack of private enterprise desirous of developing these areas. It is interesting to note that whereas the population of the Melbourne metropolitan area (that is within a radius of ten miles) is over half a million, the population within the areas in which a supply of electricity is available amounts to only about 260,000.

In regard to the likely growth in the demand for electricity for power purposes, one has only to look at the Government Statist's annual return of factories, to come to the conclusion that Melbourne is not yet a manufacturing center. Especially is this the case in the city area. The return for the year 1907, which is the latest published, shows that the actual horsepower used in factories during that year amounted to about 35,000, of which steam accounted for 27,000, gas and oil 4,000, and electricity 4,000. Taking the figure for steam power, and deducting those representing the electric power houses, tramways, etc., we obtain a net figure of about 20,000 horsepower, which, together with that representing the gas and oil power, gives us about 24,000 horsepower remaining as a possible field for development. In passing, it may be of interest to note that of this amount of steam, gas and oil power the city area can only claim about 8,000 horsepower, the balance being situated in the surrounding portion of the metropolitan area.

C. H. Merz, in his report on the "Generation of Electric Power in Victoria," recently presented to the Victorian Government, estimated the power that will be required in factories in Melbourne in 1916 at 55,000 horsepower. A perusal of this report will show that this estimated amount of power is based on the Government Statist's figures for the year 1906, which give the actual power used in factories for that year at about 30,000 horsepower, which, it should be noted, includes not only the power of the present power houses, but that of the motors which were at that time connected to their mains, totaling about 9,000 horsepower. For the purposes of this estimate, therefore, the factory power in 1906 should be reduced from 30,000 to 21,000 horsepower. Mr. Merz estimates that by 1916, in consequence of the development of industries due to a cheaper bulk supply, the increase in factory power will amount to 20,000 to 25,000 horsepower. If such be realized, then the total estimated horsepower in factories in 1916 would be 46,000 horsepower instead of 55,000 horsepower. To obtain this result it would be necessary to increase yearly at the rate of 2,500 horsepower for factories alone, which is a result that even under the special conditions that a special bulk supply is supposed to create, may be considered rather optimistic. It is pleasing to know, however, that such a hopeful future has been estimated for Melbourne by a man of Mr. Merz's undoubted experience.

The following table has been prepared with the object of showing the cost to various trades in the city area for a supply, under present conditions and prices:

	Horsepower of Motors Installed.	Revenue per Rated Horsepower.
Printers	307.50	$22.18
Newspaper offices	368.25	16.97
Clothing and boot manufacturing	247.75	39.29
Metal and wood-working.	624.75	23.16
Dairy produce merchants	142.25	14.85
Refrigerators, etc.	59.50	37.60
Elevators, hoists	510.50	14.62
Miscellaneous	121.50	20.72

The great bulk of the consumers in the various trades mentioned take their supply during the ordinary workshop hours, that is, for about eight hours per day. In some cases the demand during these hours is fairly constant, or in other words, the load factor is comparatively high, and in such cases the consumers avail themselves of the option to be charged for their power at the maximum demand rate.

It will be noticed that in the case of

[1] Abstract of presidential address delivered by H. R. Harper, City Engineer of Melbourne, before the Electrical Association of Victoria, Australia.

newspaper offices, the maximum demand is heavy in proportion to the total energy taken, and the revenue per horsepower is very low. Fortunately this class of power, in the case of the morning papers, is taken at a time when the demand on the supply station is small. A still lower revenue is obtained from elevators, on account of their very intermittent demand. But for the fact that the diversity factor of such machines is high, this class of business would, comparatively speaking, be undesirable. On the other hand, refrigerator plants run for a great number of hours daily, and in consequence the revenue per horsepower is correspondingly higher. It must be noted that the figures in the table are based on the rated horsepower of the motors installed, and not on the maximum demand of the supply, which is not easily obtainable in those cases where the charge for electricity is made at the ordinary or flat rate.

The great bulk of the power at present connected to the mains of the several undertakings in the metropolitan area comprises those installations of but moderate size, in which the price of electricity is not of so important a factor as it will be in the larger installations at present run by steam and other forms of power, and to these the question of cost is one of vital importance. Further, in the latter class will be included a number which, owing to the special conditions surrounding their operations, such as excellent individual load factor, are able to generate their own power as cheaply as, if not cheaper than, at which any public undertaking with its less favorable load factor and its distributing losses could supply. The present development of a power demand on the supply undertakings has been greatly instrumental in reducing the cost of production by the building up of a day load on the plant, which otherwise to a large extent would have been lying idle, and there is every reason to expect that with further development of such demand, and the installing of larger and more efficient generating units, the cost of production will still further be reduced.

Many tests have been carried out by the Electric Supply Department of the City Council, on tungsten lamps, which confirm what has already been said in regard to the efficiency and life of such lamps. Many of the lamps tested ran for several thousand hours, and then showed only a very small increase in the consumption per candlepower. Although the price of tungsten lamps is high, there is every possibility of their being greatly reduced as the methods of production improve. Taking present prices, however, it seems that after about 120 hours' burning the saving in current at present rates of supply pays for the first cost of the lamp, and during the subsequent life of the lamp the cost of burning is about one-third of that of the old carbon-filament lamp, for equal candlepowers. Owing to the great brilliancy of the filaments, the installation of these lamps should be carefully thought out, with the object of preventing as far as possible the direct rays of light striking the retina of the eye. Here that new brand of engineer, the illuminating engineer, should step in, and with his superior knowledge educate the user as to how to get the best results for the minimum expenditure of money.

There is a decided tendency on the part of consumers, and shopkeepers especially, to fix these lights at too low a level evidently with the idea of attracting notice. This practice should be as far as possible discountenanced, and the lamps should be placed at such a height that with the aid of well-chosen and efficient reflectors, such as the Holophane, uniform distribution is obtained without undue sacrifice of economy. Some form of reflector is absolutely necessary with these lamps, as owing to the disposition of the filament in the lamps, most of the light is given off horizontally, leaving only about ten per cent thrown down vertically. In the larger lamps fitted with spherical bulbs, it will be found desirable to frost the lower half of the lamp in order to get the best results. The manufacture of these lamps in the higher candlepowers, such as the 100, 200 and 300 candlepower, will be very advantageous for the lighting of large spaces, such as public halls and large shops. The ordinary sixteen and thirty-two-candlepower carbon lamps were failing altogether to meet the demand for such lighting, and it seemed likely at one time that the high candlepower gas lamps would take their place. All this has now been changed, and in this particular field, electric light has nothing to fear from the competition of gas. A further advantage should accrue from the use of metal lamps, in that the cost of installations per candlepower should be much less than under the old conditions.

With the same current density of subcircuits and a similar number of subcircuits, a far greater amount of candlepower can be installed, or expressed in another way, a less amount of wiring should suffice for a given candlepower. Further, in places of bunches of lights, involving the use of elaborate fittings, can now be installed single, high-candlepower lamps giving equal light, but at less installed cost. Fortunately for the supply undertakings the introduction of the metal lamp into this country has been much later than in the old countries. Following quickly on the heels of the low-voltage lamp has come the high-voltage lamp, and the fact that, so far, the minimum size of the latter is fifty candlepower, has retarded, and, we hope, will prevent, that reduction of output and revenue that has been such a feature of many of the supply undertakings in the old country. The high-voltage lamp will help the supply undertakings here to avoid the introduction to any great extent of that additional and unnecessary link, the auto-transformer. While these great improvements have been taking place in electric incandescent lighting, our gas friends have also been hard at work raising the efficiency of their lamps. It is said that imitation is the sincerest form of flattery. Well, we can congratulate ourselves on the fact that gas lighting in its recent developments has endeavored to copy many of the features of electric lighting, not excepting even the external appearance of some of our accessories. This may be considered a strong testimony as to the convenience and other attributes of electric lighting. Nevertheless, our gas friends are keen after business, and competition between the two kinds of light is at the present time a severe one. From the efficiency of twenty candles per cubic foot of gas in their ordinary mantles, they are now producing, by aid of inverted mantles and compressed gas, lamps for which they claim an efficiency as high as sixty candles per cubic foot. This progress, but for the metal lamps, would have been a serious handicap for the electrical industry. At the present time, however, the prospects of electric lighting can be considered very satisfactory, and judging by the inquiries and interest taken in the introduction of metal lamps among the city consumers, there seems every likelihood of great future expansion.

Third Avenue Foreclosure Sale.

The foreclosure sale of the property and franchises of the Third Avenue Railroad Company has again been postponed by Judge Lacombe in the United States District Court until January 11, 1910.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING ABROAD.

BY H. THURSTON OWENS.

The subject of public lighting in Europe is indeed a broad topic, but the conditions as well as the lighting are so entirely foreign to those found at home that we may readily discuss the problem as a whole.

Speaking broadly, it is safe to say that in Europe the lighting fixtures are better in both appearance and design, the different types of lamps are used more judiciously, and last, but not least, the lately developed or improved types in general use far outshine anything which America has to offer.

FIG. 1—ARC LAMPS IN THE HEART OF LONDON.

The foregoing remarks may hardly be considered as new, for similar statements can be found in the columns of the technical press for years, if not decades.

That these conditions will not always remain true is the earnest hope of all interested, and this matter is presented by the author in the hope that the subject will receive increasing attention from those who are so actively aiding the cause of general civic improvements in the ever-growing municipalities on this side of the Atlantic Ocean.

LONDON.

The world's metropolis is notable among the large cities of the globe for the homogeneous character of its population, this being due in large part to the small percentage of foreign born. In the matter of government the many cities and boroughs, which combine to give London its position, cling tenaciously to their authority and privileges, and this is nowhere more strikingly shown than in their public lighting.

London not only has the largest number of public lamps but also the greatest variety. If all of the various types were investigated by a visitor there would probably be little left to ponder over, for how street lighting should not be done is exemplified as well as how it should be.

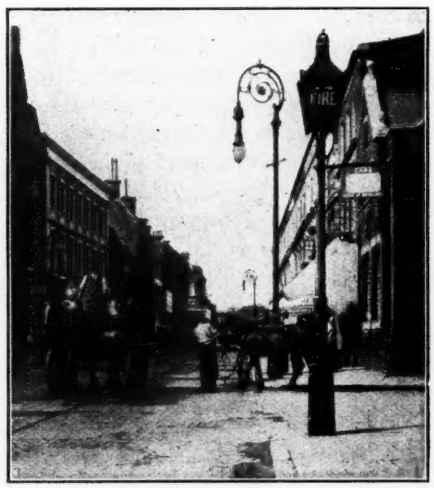


FIG. 2—IN ONE OF LONDON'S NUMEROUS SUBURBS.

The lamp in the foreground in Fig. 1 is an open arc and the lantern has panes of roughed glass. Now while it is undoubtedly true that we want diffusion, we can obtain it with less loss of light and also without such an ungainly lantern. This has been done in the case of the lamp in the background, by using an opal globe. It might also be said in passing that this is one of the few wide streets in London.

A somewhat more elaborate fixture is shown in Fig. 2 and is a fair example of the art standard in lamp-post design which one may find in that city. The fire-alarm lamp is lighted by means of gas, and its already unsightly appearance is not improved by the sign, "Cars stop here if required."

Probably the handsomest installation in the city is on Oxford Street, shown in Fig. 3, where twin flame arcs have been erected down the center of the roadway. The lamps have inclined carbons and their light is pink in color. The lighting effect is altogether too uneven to be called good, but, of course, is a long step in the right direction.

A number of the narrow streets have the same type of lamp centrally suspended by means of wires, and these probably are doing the best lighting service. This method of suspension was recently recommended by the deputation which the City of London sent to the Continent last spring.

FIG. 3—LONDON. TWIN FLAMING ARCS ON OXFORD STREET.

THE HAGUE.

Another example of central suspension, which surely ranks as a novelty, is shown in Fig. 4, where the feed wires run down the center of the narrow street much the same as an overhead trolley. The lamps are incandescent clusters in clear glass

enclosing globes. The use of small units for public lighting is quite generally confined to gas throughout Europe, but the most successful use of electricity for this purpose is with the flaming type of arc lamps, such as the one shown in Fig. 5.

FIG. 4—THE HAGUE. SUSPENDED INCANDESCENT CLUSTERS.

In this case, however, the arc is only used until midnight, when it is turned off and the incandescent lamp, with which the post is also equipped (note the left-hand side), is then turned on.

The practice of suspending the trolley wires from buildings is quite in vogue,

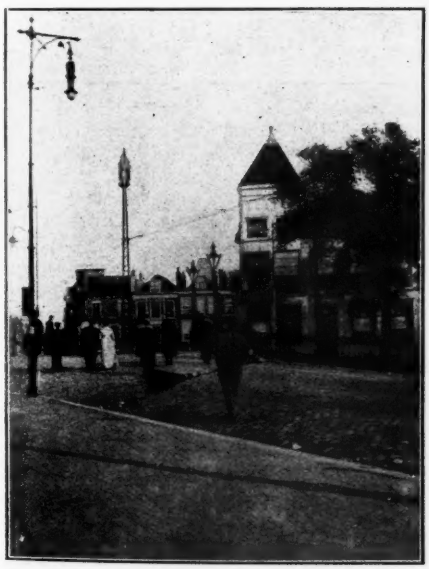


FIG. 5—THE HAGUE. ORNAMENTAL POLES FOR ELECTRIC LIGHT AND POWER CIRCUITS.

but upon wide streets very often the lamp-post has an arm for the purpose of carrying these wires. This is not the only method by which unsightly poles in excessive number are done away with, for the tower shown in the background of Fig. 5 carrying wires, above the tops of the buildings, is only one of many.

BERLIN.

Among the large cities of the world there is probably none which would furnish greater food for thought among Americans interested in civic improvements than Berlin. This is especially true, as, owing to its location and environments, it is more like the kind of city which our municipalities are destined to grow into. It is level, with great square blocks of business buildings in its center which make it out of all reason to improve by means of parkways, but as soon as one reaches the growing outlying sections the effects of modern comprehensive city planning are at once evident.

Practically the only breathing space in the heart of the city is the celebrated "Unter den Linden," which extends from

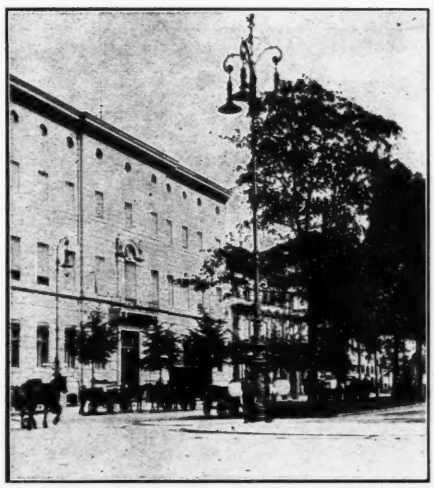


FIG. 6—BERLIN. OPEN ARCS, UNTER DEN LINDEN.

the palace of the Kaiser to the "Central Park" of Berlin, the Thiergarten. This is lighted by means of open arcs with opal globes, and that they are installed in profusion and upon posts which are ornamental as well as massive may be judged from Fig. 6, where the trimmer is at work upon a cluster of globes which have been lowered.

This illustrates two features of street lighting abroad which are much in evidence. Reflectors are used upon practically all lamps except the modern flaming arcs, and lowering gear seems to be regarded as quite an essential, even the high-pressure gas lamps having this feature.

Where Unter den Linden meets the Thiergarten the famous Brandenberger Thor (gate) is located, and in the center of the plaza undoubtedly the most massive public-lighting fixture in the world has been erected. This is shown in Fig. 7. The lamps are fifty-nine feet above the pavement and are of the inclined carbon type, giving a white light with clear globes, the four lamps of each set consuming 4,400 watts. This combina-

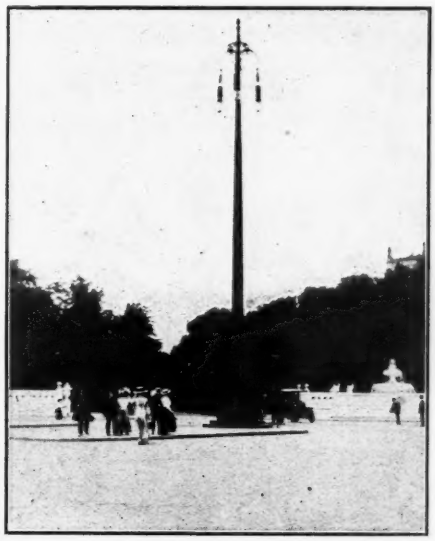


FIG. 7—BERLIN. THE FAMOUS BRANDENBURGER PLATZ.

tion produces the most startling lighting effect the writer has ever seen in public lighting, due principally to the great volume and the high intensity of illumination.

The inverted high-pressure gas lamps are not used in a similar manner and therefore they are not at all comparable. They are used principally upon wide

FIG. 8—POTSDAM, GERMANY. NEAR THE PALACE OF THE KAISER.

boulevards with trees and are hung less than twenty feet above the pavement. These streets represent the best lighting that is done by means of this illuminant in the world and incidentally the intensity of the illumination is several times

that of anything the writer has seen in this country.

From a lighting standpoint, the best electric installation which the writer saw abroad was also in this city upon Friederich Strasse, where Alba vertical carbon,

FIG. 9—MUNICH. IN THE HEART OF BAVARIA.

white-flame arcs are hung by means of wires about twenty feet above the pavement. Both the distribution and the color of the light is far more effective

FIG. 10—MUNICH. THE OLD AND THE NEW.

than that from the inclined carbon, pink-flame lamps.

The lighting fixtures in Berlin do not compare favorably with those of the same recent models to be found elsewhere in Germany, one in use at Potsdam being shown in Fig. 8. This town is the Windsor of Germany and, as in the latter place, the fixtures include a crown among their decorative features.

MUNICH.

The German Empire in its outward aspects is still the federation of states brought into political unity by Kaiser Wilhelm der Grosse nearly four decades ago. To the ordinary traveler Bavaria might be regarded as an independent kingdom as far as outward appearances are concerned, but to the engineer the evidences of modern progress bring the state in closer harmony with its sisters. On arriving at the central railroad station we find the plaza decorated as well as excellently illuminated by means of flame lamps upon handsome posts, as shown in Fig. 9, the crest at the top being the celebrated Bavarian lions.

The change from the old to the new is

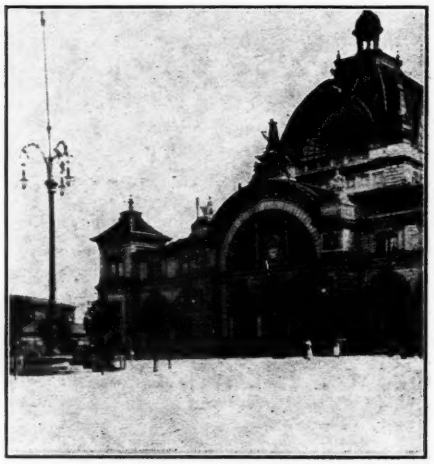


FIG. 11—LUCERNE. COMBINED LAMP-POST AND FLAGPOLE.

illustrated in Fig. 10, where the low-pressure gas lamp has been displaced by its newer and larger brother, the flame arc, and in the latter we again see the effort to build something which is attractive as well as utilitarian.

LUCERNE.

Lucerne, the Mecca of all Alpine tourists, like other cities in beautiful Switzerland, has many lighting fixtures which add to its attractiveness, but the one shown in Fig. 11 certainly has the additional merit of novelty. Flame arc lamps upon handsome standards are surely not novelties, but the two, of which one is shown, are surmounted by flagpoles of no mean height.

The building shown, by the way, is not a place of justice nor a city hall, but the railroad station. The matter of appearances is not neglected where but few of the public would take notice, for in Fig. 12 we have a typical railroad-yard lighting equipment.

PARIS.

The lighting of Paris has become almost a byword in the minds of so many that a word of criticism may not be amiss.

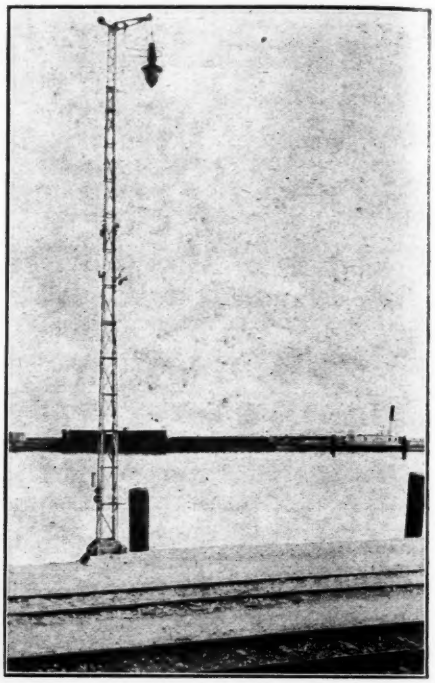


FIG. 12—LUCERNE. TYPICAL RAILROAD YARD LIGHTING EQUIPMENT.

The providing of the most magnificent boulevards based upon the largest and most comprehensive plan which has ever been carried out and lighted in a man-

FIG. 13—PARIS. IN THE SHADES OF THE LOUVRE.

ner which has been the envy of all the world is the record of Paris. What was true five years ago in lighting, however, is not true today, for scarcely any other branch of applied science has advanced more rapidly, and Paris has responded

but feebly to the demands for more modern methods, with the result that many of her celebrated installations have been outdone.

The greatest criticism, however, is to be made regarding what she has done. The prominent people who have not strolled down Avenue de L'Opera are few indeed, and the compliments paid upon the former lighting have reached to the ends of the earth, but in order to satisfy the demands for higher intensities Paris has done at least one thing which is apparently inartistic.

Inclined carbon, pink-flame arcs have been placed close together upon the streets, in three rows, one on each curb and one down the center, but they are hung only twenty feet high!

The only possible excuse could have been the desire for uniformity in the design of the fixtures, for they are somewhat similar to that shown in Fig. 13, which follows the general lines of the electric posts in use throughout the entire city.

A New Electric Miner's Safety Lamp.

In a recent number of *Electrical Engineering* (London) there is described an interesting electrical safety lamp with some rather unique features. It consists of a metallic-filament lamp placed in front of a strong parabolic reflector and behind a glass lens, so that a beam of twenty candlepower measured along the focal axis is obtained. This is operated from a four-volt cell contained at the base of the lamp.

In conjunction with this, however, at the back of the lamp is a small oil lamp protected both with a glass shield and a piece of gauze, which is intended for testing for gas in the usual way. A switch is arranged whereby the light from the electric lamp can be turned off, and simultaneously a current is passed through a platinum wire, by means of which the oil lamp is ignited. In order to prevent both oil lamp and electric light glowing simultaneously, when the latter is switched on, a snuffer over the oil lamp is brought into operation, so that they cannot both burn at once. Moreover, in a gassy mine, an arrangement is supplied on the lamp for shutting off the air supply to the oil lamp in order to extinguish the flame. The weight of the whole equipment, which is intended to burn from fourteen to twenty hours continuously, is only five pounds, and it is possible to produce a lighter lamp to burn for an eight-hour shift.

Enclosed Arc Lamp.

A recent improvement in the enclosed arc lamp is disclosed in an American patent recently granted to Adrian Denman Jones, of London, England. This lamp uses electrodes treated with calcium tungstate, calcium fluoride and sodium tungstate or potassium sulphate. The high vapor density of the gases given off when this mixture fuses insures a comparatively small arc, the effect being that the vapors are heated to an extremely high temperature. The lamp efficiency is consequently high.

As the lamp is air-tight, or practically so, it was necessary to provide a suitable system of chambers for the circulation of the gases. This circulation is effected through the three tubes (*A*), (*E*), and (*D*), shown in the accompanying diagram.

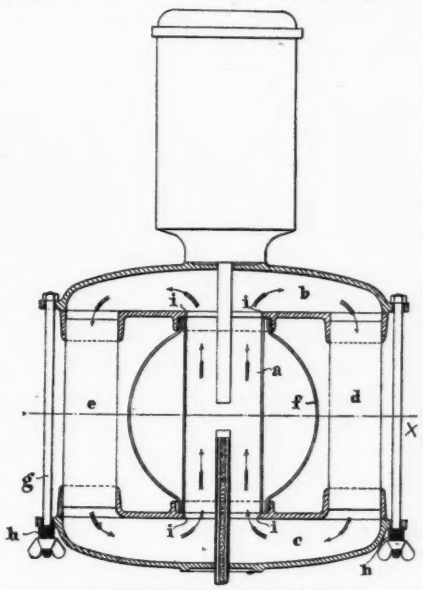


DIAGRAM OF JONES LAMP.

(*A*) is a transparent or translucent tube surrounded by a suitable globe (*F*). The surrounding globe has a tendency to increase the temperature of the chamber (*A*), and thus prevent the formation of a deposit therein.

Electric Lighting for Irish Cathedral.

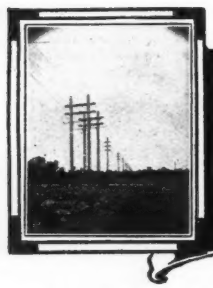
It has been decided to take out the entire gas fittings of St. Patrick's Cathedral, Dublin, Ireland, and replace them by electric-light fixtures. The contract, which was awarded to the firm of W. Coats and Son, calls for an expenditure of nearly $5,000. Electrically driven rotary blowers are to be substituted for the hydraulic blowers at present in use for working the organ. Evidently St. Patrick's is not to be outdone by the Bombay Cathedral in keeping up with the march of progress.

Electric Light and Power on Governor's Island.

Governor's Island, the picturesque military post lying almost at the gateway of New York harbor, was probably one of the best-known depots of its kind in the world. It was ceded by the city of New York to the United States Government in the early days of the republic, and has been used for military purposes upward of a century. It is now the headquarters for the Atlantic Division of the United States Army and the department of the East. It has a population of about 400, exclusive of the 300 military prisoners confined in Castle William—the old-fashioned, round-tower fortress at the northwest corner of the island.

Until three or four years ago, strange as it may seem, this community, with its generals, colonels and captains—its pretty villa houses—its public buildings and barracks, situated almost within a stone's throw of the great metropolis of America, possessed no modern system of illumination and was lighted exclusively by the flame of kerosene oil. About the time mentioned, the government laid a cable from Brooklyn to Governor's Island, and contracted with the Edison Illuminating Company, of Brooklyn, to supply electric energy to the island. The company delivers primary current to this cable on the Brooklyn side, which is transformed and distributed at the rotary station on the island. Every building is wired and the entire island, including the streets, is now lighted exclusively by electricity.

Electrical energy is now to be used on the island for another purpose—to provide adequate protection against fire. The means hitherto used for this purpose have been humorously primitive. Power pressure in cases of fire has been supplied by the engine of the little ferry boat which plies between the island and the Battery, in Manhattan. If a fire broke out while this boat was on its way to Manhattan, there was nothing to do but wait for its return to the island. In the first part of October a fire occurred while the ferry boat was away from its island moorings and considerable damage resulted before the conflagration could be extinguished. Uncle Sam's eyes were opened at last, and it was proposed by the authorities at Washington to install an up-to-date, high-pressure, fire pumping plant. The plant, which will consist of an electric motor with six-inch, three-stage turbine pump, throwing a four-inch stream, is now being installed and will be ready for use in two or three weeks.



CENTRAL-STATION-PRACTICE

Transmission-Interior Wiring

Electrically Heated Household Appliances.[1]

The load curve of the average distributing station usually presents an appearance resembling the profile of the Rocky Mountains, the valleys representing the average load for twenty-four hours, and the highest peaks representing the maximum load for short intervals, at which time the generating apparatus is taxed to its utmost. If we average the "altitudes" of the peaks and the valleys, and divide this value by the maximum power demanded during a certain period of twenty-four hours, we obtain what is called the "load factor." Sometimes the load factor is defined as being the ratio of the average load[2] during a given period of time to the normal capacity of the station.[2]

The load factor of the central station is a subject which materially affects the financial success of the station. Therefore, progressive managers throughout the entire country have turned their attentions toward making the ratio above referred to as high as possible. The cost of managing the system and distributing the electrical energy is not merely the operating expense of the station but includes the depreciation on the equipment and interest on the money invested. The operating expense may be divided into two classes, one class dependent on the load, and the other class independent of the load. It is, therefore, evident that a station with a large kilowatt output will have a cheaper operating cost per kilowatt-hour than will a similar station of smaller kilowatt-hour output. It has been found by experience that it is almost as economical from an operating standpoint to deliver two kilowatt-hours as it is to deliver one kilowatt-hour, assuming, of course, that the plant is of sufficient capacity to take care of the large load. It will, therefore, be seen that a high load factor, meaning a high kilowatt output, would considerably lower the cost of operation of a given station. Medium and large size stations consider a load factor of thirty-five per cent to be very good, indeed, and a load factor of fifty per cent to be excellent.

Of course, to increase the load factor, it is necessary to fill in the "valleys" above referred to, and in the case of stations, the majority of whose load is a lighting load, can best accomplish this result by securing a daylight load.

The daylight load is secured by the installation of motors and heating devices. How many central managers are there who walk down their brilliantly lighted thoroughfares in a blaze of light from electric signs, which have been placed on the system by the strenuous efforts of solicitors? The electric sign business is undoubtedly profitable to the central stations, but if you will stop a moment and consider the effect which would be obtained if electric signs were in use during the morning, the noon and the evening meal hours, you will find an incentive in instituting a vigorous campaign in behalf of electrically heated devices. In other words, suppose that you had an equivalent connected load of heating devices in service during the morning, noon and evening meal hours, do you not agree that the load factor would be materially improved, and the cost of generation per kilowatt-hour materially reduced? The experience of companies that have extensively exploited electric heating devices will confirm the truth of such arguments. Think of the energy lost while operating a large generating plant at the reduced efficiency ensuing from a small load. Suppose that the central station in which you are interested had connected to its lines fifty or one hundred cooking outfits, and that the average loads of such outfits were represented by the values given in the table below.

Then notice the contrast with the table representing an average lighting load.

I wish to call your particular attention to the flatiron load herein enumerated, and to the advantageous time during which it is in service.

The above values were taken from actual experience and may be considered as being a fair average for a family consisting of three or four persons. In the particular case above referred to, the consumer used current during the previous year to the amount of $35 for light, and after the installation of the heating and cooking devices, his bill was increased to approximately $110 per year, showing an increased income to the central station amounting to about 200 per cent for this particular residence. This case illustrates what can be done, and what should be done, in exploiting the electric heating business. Notwithstanding the great increase in revenue to the central station, the consumer's bill was approximately the same as it had previously been when using gas and coal for cooking purposes.

In introducing heating and cooking devices, public demonstrations are of great value, but under no condition should the demonstration be in the hands of a person incompetent and unfamiliar with the details of the devices. A great amount of interest is always shown in displays

COOKING AND HEATING DEVICES.

	Breakfast, 6:30-8:00	Baking, 8:00-11:00.	Ironing, 7:00-11:00.	Dinner, 11:30-1:00.	Misc. Day.	Supper, 4:30-8:00.	Misc. Night.	Total.
Monday....	¾ kw.-h.	1 kw.-h.	0 kw.-h.	1½ kw.-h.	¼ kw.-h.	½ kw.-h.	0 kw.-h.	4 kw.-h.
Tuesday ..1	kw.-h.	0 kw.-h.	2½ kw.-h.	1½ kw.-h.	½ kw.-h.	1 kw.-h.	½ kw.-h.	7 kw.-h.
Wednesday	¾ kw.-h.	3 kw.-h.	0 kw.-h.	¾ kw.-h.	0 kw.-h.	½ kw.-h.	0 kw.-h.	5 kw.-h.
Thursday..	¾ kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	¼ kw.-h.	0 kw.-h.	0 kw.-h.	2 kw.-h.
Friday 1	kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	0 kw.-h.	½ kw.-h.	½ kw.-h.	3 kw.-h.
Saturday...	¾ kw.-h.	3 kw.-h.	0 kw.-h.	¾ kw.-h.	1 kw.-h.	½ kw.-h.	0 kw.-h.	6 kw.-h.
Sunday.....	½ kw.-h.	0 kw.-h.	0 kw.-h.	2½ kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	4 kw.-h.
Total....5½	kw.-h.	7 kw.-h.	2½ kw.-h.	9 kw.-h.	2 kw.-h.	3 kw.-h.	2 kw.-h.	31 kw.-h.

LIGHTING LOAD.

Monday	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	½ kw.-h.	1½ kw.-h.
Tuesday....	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	¾ kw.-h.	¼ kw.-h.	1 kw.-h.
Wednesday.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	½ kw.-h.	1½ kw.-h.
Thursday...	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	1 kw.-h.	2 kw.-h.
Friday.....	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	¾ kw.-h.	¼ kw.-h.	1 kw.-h.
Saturday....	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	½ kw.-h.	1½ kw.-h.
Sunday.....	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	¾ kw.-h.	¾ kw.-h.	1½ kw.-h.
Total....	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	0 kw.-h.	6¼ kw.-h.	3¾ kw.-h.	10 kw.-h.

[1] Abstract of a paper by A. G. Jones, read at Joint Convention N. W. Electric Light and Power Association and Seattle Section A. I. E. E., Seattle, September 7, 8, 9, 1909.

[2] Several other definitions are also given by various authorities. [Ed.]

and demonstrations of electric heating and cooking devices. Besides the attractive appearance of the goods, they seem to have a fascination which cannot be easily explained. They are clean, sanitary, quick in operation, and ornamental, reasons which undoubtedly appeal to the most critical housewife.

The layman usually has a more or less vague idea as to the meaning of the watts rating as will be found on the nameplate of heating devices, and, perhaps, the simplest way to make such a rating comprehensive to the public is to reduce the rating in watts to an equivalent number of sixteen-candlepower, 110-volt, carbon lamps. The standard 110-volt, sixteen-candlepower carbon lamp consumes about fifty-six watts; therefore, if the watt rating on the nameplate of the heating device be divided by fifty-six, the "lamp equivalent" will be obtained. If the consumer will, therefore, compare the lamp equivalent of the heating device which he proposes to use, he will have a very good general idea of what he might expect the operation of the heating device will cost, by comparison with previous lighting bills. If electric cooking and heating is employed extensively in any given house, it is desirable to have the entire circuit separate from the lighting circuit, and metered by an independent meter. In this way the consumer can obtain definite figures as to the actual cost of cooking or heating by electricity. Often the installing of a curve-drawing wattmeter for a short time will prove instructive both to the customer and the lighting company.

The importance of heating-device displays in the exhibit rooms or offices of central stations will not be questioned by the most skeptical manager, and in order that such a display may be most effective and interesting to prospective customers, the articles chosen should be representative and few in quantity, rather than simply a miscellaneous collection of a complete line. To be most attractive, they should be surrounded by articles in keeping with their use. For instance, a chafing-dish on a well-finished table with a few dainty dishes and some silverware will catch the eye of an apparently disinterested person much quicker than would a general conglomeration of heating devices. The coffee percolator and the toaster, when in operation, make a very attractive display. In other words, the more ornamental the appearance of the general display, the more effective it will be.

The heating units in various electric appliances vary materially with different manufacturers and with the particular article in question. The units may, however, be divided into three general classes, known as: (1) Flat unit; (2) the well-known cartridge unit; (3) a unit composed of resistance wire wound on mandrels of various shapes.

A typical flat unit consists of a stamping of the desired shape made from a solid sheet of specially prepared resistance metal of very thin cross section. This is placed between thin sheets of amber mica, and securely clamped in position, which brings the resistance material in close thermal contact with the surface to be heated. Such a unit is ideal for flatirons, percolators, small disk stoves, and other appliances where an even temperature is required over the entire surface.

The cartridge unit consists of a spiral of suitable resistance wire wound on edge, each layer being insulated by a powdered material resembling porcelain. The spiral is then encased in a metal cartridge, after which it is baked to a very high temperature. This type of unit is eminently well suited for instantaneous water heaters, and other devices which do not require uniform heating of a flat surface. The cartridge unit is also used with great success in flatirons, since the metal composing the iron can be shaped in such a manner as to produce an even temperature on the smoothing surface of the iron. This is accomplished by putting a great amount of metal in the proper place, and also by forming an air space directly beneath the cartridge unit, that is, between the unit and the surface of the iron, thus preventing the center of the iron from becoming too hot and insuring a uniform heat on the working surface. The cartridge unit has the advantage of being very easily renewable, and also has a remarkably long life.

The various heating units constructed from ordinary round resistance wire wound on suitable mandrels have many applications, but broadly speaking do not admit of the most efficient utilization of heat.

Great care should be exercised by the agent or solicitor in selling heating devices to be certain as to the voltage of the circuit upon which the device is to be used. A large percentage of the trouble with heating devices is due to using such devices on circuits of voltages varying widely from that for which the unit is designed. In order to get the maximum efficiency from a heating unit, it must be designed rather closely to its voltage limit, and for this reason heating devices should not be used on circuits varying more than five per cent from the rated nameplate voltage. An excessive voltage, of course, results in short life, and low voltage results in dissatisfaction caused by the great length of time taken for the unit to come to a working temperature.

The application of heating and cooking devices is very broad. The table given below, being taken from the Solicitor's Handbook of the National Electric Light Association, gives a very complete outline of the most useful devices. The table gives the name of the material, the energy consumed and the cost of operation per hour at five cents per kilowatt-hour:

Apparatus.	Watts.	Cents per Hour.
Broilers, 3 ht.....	300 to 1,200	1.5 to 6
Chafing dishes, 3 ht....	200 to 500	1 to 2.5
Cigar lighters.....	75	0.375
Coffee percolators for 6-in. stove.....	100 to 440	0.5 to 2.2
Coil heaters.....	110 to 440	0.5 to 2.2
Corn poppers.....	300	1.5
Curling-iron heaters....	60	0.3
Double boilers for 6-in., 3 ht. stove.....	100 to 440	0.5 to 2.2
Flatiron (domestic size), 3 lb.....	275	1
Flatiron (domestic size), 4 lb.....	350	1.4
Flatiron (domestic size), 5 lb.....	400	2
Flatiron (domestic size), 6 lb.....	475	2.4
Flatiron (domestic size), 7.5 lb.....	540	2.7
Flatiron (domestic size), 9 lb.....	610	3.05
Foot warmers.....	50 to 400	0.25 to 2
Frying kettles, 8-in. diameter.....	825	4.125
Griddle-cake cookers, 9 by 12 inches, 3 ht....	330 to 880	1.7 to 4.4
Griddle-cake cookers, 12 by 18 inches, 3 ht....	500 to 1,500	2.5 to 7.5
Heating pads.....	50	0.25
Instantaneous flow water heaters.....	2,000	10
Kitchenettes (complete), average.....	1,500	7.5
Nursery milk warmers.	450	2.25
Ornamental stoves.....	250 to 500	1.25 to 2.5
Ovens	1,200 to 1,500	6 to 7.5
Plate warmers.....	300	1.5
Radiators	700 to 6,000	3.5 to 30
Ranges, three heats, 4 to 6 people.....	1,000 to 4,515	5 to 22
Ranges, three heats, 6 to 12 people.....	1,100 to 5,250	5.5 to 26
Ranges, three heats, 12 to 20 people.....	2,000 to 7,200	10 to 36
Shaving mugs.....	150 to	.75
Stoves (plain), 4.5 in., 3 ht.....	50 to 220	0.25 to 1.1
Stoves (plain), 6 in., 3 ht.....	100 to 440	0.5 to 2.2
Stoves (plain), 7 in., 3 ht.....	120 to 600	0.6 to 3
Stoves (plain), 8 in., 3 ht.....	165 to 825	0.75 to 4.125
Stoves (plain), 10 in., 3 ht.....	275 to 1,100	1.3 to 5.5
Stoves (plain), 12 in., 3 ht.....	325 to 1,300	1.6 to 6.5
Stove, traveler's.....	200	1
Toasters, 9 in. by 12 in., 3 ht.....	330 to 880	1.6 to 4.4
Toasters, 12 in. by 18 in., 3 ht.....	500 to 1,500	2.5 to 7.5
Urns, 1-gal., 3 ht.....	110 to 440	0.5 to 2.2
Urns, 2-gal., 3 ht.....	220 to 660	1.1 to 3.3
Urns, 3-gal., 3 ht.....	330 to 1,320	1.3 to 6.6
Urns, 5-gal., 3 ht.....	440 to 1,700	2 to 8.5
Waffle irons, 2 waffles..	770	3.75
Waffle irons, 3 waffles..	1,150	5.75

In addition to the above table of household heating and cooking utensils, there are a number of other useful devices, such as glue pots, soldering irons, leather-finishing tools, drying tables for use in printeries and binderies, etc.

Heat energy is derived from electric

energy by passing the current through a resistance of suitable dimensions. The amount of heat energy dissipated will depend absolutely on the product of the resistance into the square of the current. From this it will be seen that the actual number of heat units can be accurately predetermined, the efficiency of the heating unit depending upon the design of the unit itself, and the design of the device in which it is used. We, therefore, have to look to the ingenious engineer to give us heating devices of high efficiency. The short life of heating units can be often traced to poor design, inasmuch as the resistor has to work at a temperature considerably above that which would be necessary if the design of the appliance in which it is used were such as to utilize the maximum amount of heat produced.

The majority of heating devices, such as the teakettles, combination cookers, water heaters, and stewpans, usually require from ten to fifteen minutes to reach the boiling point, whereas, with the grids, hot plates, and such devices as require rapid heating, they take only from two to six minutes to reach an operating temperature, assuming, of course, that the surrounding temperature is normal.

The electric coffee percolator is especially representative of the rapid strides which have been made in the art of design and manufacture of heating devices within the past several years. Actual tests on a one-and-one-half-pint size of percolator prove that water drawn from a hydrant, direct, at a temperature of eighteen degrees centigrade, required only forty-five seconds to start to percolate, and only one minute and forty seconds in the three-pint size. In either case the percolation proceeds very rapidly, and the coffee is finished in ten minutes or less. Such results are due to the improvement in the design of the heating unit, and also to the improvement in the design of the "pump" in the latter designs.

Increase in N. E. L. A. Membership.

During the recent campaign for the extension of the National Electric Light Association, the membership has increased from 1,300 to a total of 3,561. At the meeting of the executive committee on October 13, the executive secretary, T. C. Martin, gave the following as the membership at that date: Class A, 743; Class B, 244; Class D, 194; Class E, 176. The most of the increase has been through the formation of local company branches.

The Storage Battery in the Electric Lighting Plant.[1]

The life of the positive element of a storage battery in ordinary use is usually taken at from five to ten years, depending on its weight, method of manufacture and use. The negative element under the same conditions will last from seven to twenty-five or thirty years, possibly longer. As the positive element, as a rule, is only about from one-third to one-half of the total cost of the battery, it is seen that the depreciation on storage batteries cannot be very high.

The storage battery is heavy, bulky and expensive. For its weight, size and cost, it strikes one, unfamiliar with it, to have an astonishingly small amount of stored energy. This is true to a certain extent. At the same time a storage battery of ordinary construction has sufficient stored energy in it to lift its own weight from five to eight miles in the air, and a storage battery constructed with a view of lightness contains sufficient energy to lift itself to at least fifteen miles.

One of the principal uses of storage batteries is regulating fluctuations of load. We are all familiar with the use of the flywheel for this purpose, which it accomplishes admirably when the fluctuations are not heavy or long sustained. Some figures on the comparative weights and efficiencies of the storage battery and the flywheel in this connection may be interesting, and in order to make the comparison, we will suppose heavy fluctuations, but not heavier than daily occur in, for instance, an electric power plant where electric elevators are operated. In one such plant in this city (San Francisco), with an average load of about fifty kilowatts, there frequently occur fluctuations of 100 to 150 kilowatts, lasting for several seconds. These fluctuations could be taken care of by a storage battery, weighing in the neighborhood of 20,000 pounds. To obtain the same regulation, a flywheel rotating at 120 revolutions a minute would have to weigh between 150,000 and 200,000 pounds. This, of course, would be absolutely absurd and would take up much more room and cost considerably more than the equivalent storage battery. If these fluctuations instead of lasting three seconds lasted thirty, the flywheel would have to be so much larger that I hate to strain your credulity. The battery, however, would carry such an overload for fifteen minutes.

One of the uses of storage batteries is the so-called "stand-by" service. In this use the storage batteries are connected in parallel with the generators. In case of any trouble with these, the battery instantly takes up the load and carries it until another generator can be put into service. Of course, in an office building, for instance, the battery can be called upon to carry the entire night load after the generators are shut down. Stand-by batteries have a very extensive development in the electric-lighting companies of large cities, and particularly where they are dependent on waterpower and long-distance transmission lines. In Los Angeles, for instance, the Edison Company, which derives the bulk of its power from the Kern River plants, has two large storage batteries. Trouble with transmission lines, due to shorts, etc., occurs with this company on an average of two or three times a month. On these occasions the storage battery steps in and continues their service until the alternate line can be put in operation. With a storage battery under such conditions, there is no interruption of the service. Without a storage battery it might be half an hour before the alternate line could be started, as it would be necessary to start up and synchronize all of the machinery before the load could be taken up. Auxiliary steam generating plants are sometimes used for this emergency service, but the objection to these is that it takes a considerable time to get up the required steam pressure in all the boilers, as would be the case during heavy load conditions, while the storage battery is automatically and instantly available.

The largest application of storage batteries, however, is for regulation purposes. The ideal condition for a power plant is an absolutely steady full load during the entire time the plant is running. Under these conditions alone can a high efficiency be obtained. Unfortunately these conditions almost never obtain. In a great many plants, however, the fluctuations are not very heavy and are often so gradual that they can be taken care of by starting up or shutting down additional units. In these cases, of course, a storage battery is not needed. When, however, we have a heavy, fluctuating load, fluctuating violently and rapidly, there is nothing that can alleviate this condition but a storage battery. This fluctuating load occurs—to use the most

[1] Abstract of a recent paper by O. W. Lillard, read before California No. 3, National Association of Stationary Engineers.

familiar instances—where electric elevators or hoists are used, and in the case of electric interurban railroads on which there are few trains or cars. The load fluctuates from zero to three or four times the average load, every few seconds, and this performance is kept up indefinitely. The fluctuations are so violent and rapid, that the governor of the steam engine cannot keep up with them. The engines are constantly pounding and the voltage of the system is unsteady. As the engines are running either at practically no load or at a heavy overload all of the time, their efficiency is very low. A storage-battery regulating installation alleviates all of these conditions by absorbing all the fluctuations above and below the average. The load on the generators is reduced to the average load and kept at that point within five per cent, under extreme conditions. By reducing the generator load to the average load on the plant, instead of a maximum of several times this, it is usually possible to shut down half the generators. In some cases one small generator will carry the load at all times where it was formerly necessary to run two large ones, the greater part of the time. Due to the fact that the load is maintained constant on the generator, the voltage of the system is absolutely constant, a variation of a quarter to a half per cent in voltage being the maximum obtained. The battery, of course, takes all shock, due to fluctuations, from the engines and enables them to run steadily and quietly at their point of highest efficiency, and with the least possible liability to accident. As the engine is running at its most efficient point, a large saving of fuel is obtained. In exceptional cases this may be as high as fifty or sixty per cent, and it usually exceeds thirty. Another advantage, which is not usually given full consideration, is the fact that the whole plant is running under absolutely steady conditions and similar to those used by experts when testing the installation. Under these ideal conditions it is easier to study the operation of each part of the plant, and tune it up to its best possible performance. In addition to the saving of fuel above mentioned, in the case of an office building the steam plant may be shut down at about nine o'clock at night and the load carried by the storage battery. This effects a further saving, especially when power for this purpose is being purchased from the electric lighting companies.

The storage battery, of course, lends itself most readily to the regulation of direct-current plants, but the fluctuating load condition occurs as often in alternating-current plants as it does in direct. The Gould Storage Battery Company has developed within the last four or five years a very practical system of alternating-current regulation by means of storage batteries and has a number of these plants in successful operation. The theory of this regulation is very similar to that of the direct-current system, and while very interesting from an engineering point of view, it would take too much of our time to go into it extensively.

Another interesting application of storage batteries is in competition with primary batteries, where facilities for recharging the storage battery exist. You are, of course, familiar with the fact that the telegraph companies at one time operated their lines from primary batteries. Now they use storage batteries exclusively. The storage battery is many times lighter and more compact than the primary battery. Its first cost is about the same, and while a storage battery in this use will last from five to eight years without renewals, a primary battery under the same conditions requires renewals every few months. The policy of the telephone companies has been the same as that of the telegraph companies.

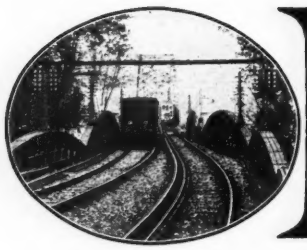
In general it may be stated that a storage battery will more than save its cost, in a year's time, in competition with a primary battery. Of course, it is understood that there must be sufficient use of current to make the installation worth while. It is interesting to note, however, that in the new large hotels, etc., a storage battery is used in preference to primary batteries for operating fire-alarm systems, call bells, interior telephones, etc. The storage battery is more reliable, and in addition to taking up less room, it requires less attention.

A very large use of the storage battery occurs in connection with the electric lighting of cars on steam railroads. This may not seem a large use until you stop to consider the number of cars so equipped and the fact that the storage-battery equipment for each car will run from $500 to $1,000. You will have seen and admired the electric automobile propelled by storage batteries. This is a fast growing branch and will probably reach high development in the next few years. I do not have to tell you that the electric automobile is noiseless and practically foolproof. It may, however, astonish you to know that it is considerably faster than the highest powered gasoline automobile for traveling in crowded city streets.

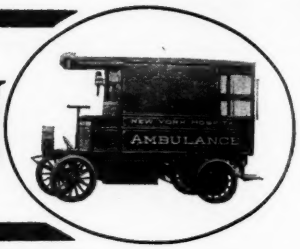
Small portable storage batteries are largely used for ignition purposes in stationary, automobile and motor-boat engines, and in this service stand a wonderful amount of abuse and use. Storage batteries are also used for operating railway and other signals, by the telegraph and telephone companies, as an adjunct to gasoline and electric-lighting plants for residences, for experimental purposes (where its steady flow and constant voltage is invaluable), and for many other purposes.

The New Generating Station at Stepney, London, England.

The new Blyth's Wharf electric generating station of the Metropolitan Borough of Stepney was opened on Wednesday, October 27, says *Engineering*, of London, Eng. The station, which is conveniently situated near the river, is a steel and ferro-concrete building, and is laid out on straightforward and modern lines, so as to be capable of considerable extension. The plant, which is arranged so that the station may work in conjunction with the present direct-current supply station at Osborn Street, consists of a 2,000-kilovolt-ampere, 6,600-volt, three-phase Willans-Bruce Peebles turbo-alternator, and a 1,000-kilowatt Parsons double-current machine, consisting of two machines in tandem, and giving direct current at 230 volts or three-phase alternating current at 140 volts. The direct-current supply from the latter machine will be used for local distribution, while the alternating-current supply will be stepped up by means of Berry transformers, and will be used in conjunction with the 2,000-kilovolt-ampere machine for bulk supply to Osborn Street, where step-down motor-converters will be installed. The turbines are fitted with "Contraflo" condensers, Edwards air pumps, and Rees-Roturbo circulating pumps, while the boiler house contains three Babcock and Wilcox marine-type boilers. The most novel feature in the station is the high-tension switchgear, which is of the Reyrolle ironclad type, and it will be interesting to see, says our contemporary, if this gear will ultimately prove capable of taking care of the output of the completed station, which is projected to contain plant of 28,000 kilowatts capacity when finished.



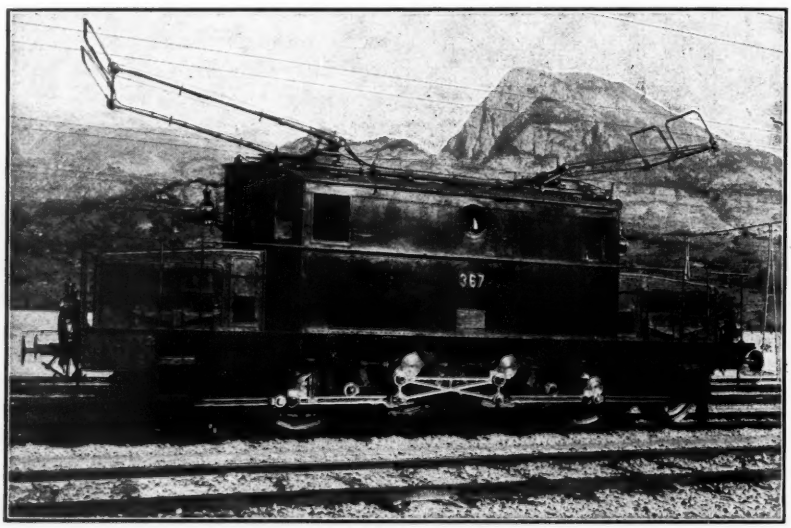
ELECTRIC TRACTION



THE NEW ELECTRIC LOCOMOTIVES FOR THE SIMPLON TUNNEL.

BY C. L. DURAND.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 20 last there appeared a brief account of the new three-phase locomotive built for the Simplon electric line. Since that time much more complete data upon the subject have come to hand, the manufacturing company, the Brown-Boveri firm, having made public the details of the new locomotive. It is therefore possible to present, for the first time, a series of views



GENERAL VIEW OF NEW SIMPLON ELECTRIC LOCOMOTIVE.

of the locomotive and also of the new motor. This latter is specially worthy of note, as it is a new departure in the way of three-phase working for heavy locomotives such as are designed for standard-gauge railroads.

The new motor is the first of the kind in which a rotor of the squirrel-cage type is employed, and it has another interesting feature in that it will give four different speeds, the former type of Simplon locomotive being operable only on two speeds. It is also claimed that the new locomotive is the most powerful one constructed in Europe up to the present time. Each of the two motors gives a maximum of 850 horsepower, according to the brake tests which were made at the factory.

In the old type of locomotive all three driving wheels are coupled to the motors. A running wheel of smaller diameter lies at each end of the chassis, and it is mounted in a bogie along with the next lying large wheel. The middle axle is independent and has a wide shift. In the new locomotive the two motors are mounted adjacent to one another under the middle of the chassis. There are now employed four driving wheels of the same diameter, thus dispensing with the small wheels. A stout drawbar connects the cranks of the two motors, and from one end of this bar there is a bar which connects to the first driving-wheel crank. A similar bar runs to the second wheel. The arrangement is similar on the other side, so that all four wheels are driven from the two motors conjointly.

In view of the fact that the small wheels are no longer used, all of the weight of the locomotive is utilized for adhesion, and the weight is equally distributed on all four axles. In order to facilitate the rounding of curves on the track, the outer axles are not made fast in the chassis. Instead of trucks or bogies, there is employed what is known as the Klienhinder system for the axles, and these latter have a radial as well as a side slip. This method has been found to work very well on some of the railroads on the Continent, and it is adopted therefore in the present case. To give a better running in the curves, the wheel diameter has been cut down from 1.64 metres

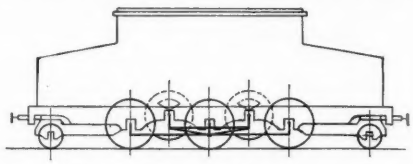


DIAGRAM OF DRIVING MECHANISM OF OLD LOCOMOTIVE.

to 1.25 metres. Provision is made at the coupling points of the bars in order to give the necessary play when rounding a curve. Owing to the fact that the cranks of both motors are coupled together, the total adhesion of the locomotive may still be used in case one of the motors should fail.

The present locomotives are designed for a higher power than is actually needed on the Simplon Tunnel section, this requiring the use of a 300-ton train at a speed of forty-three miles an hour on a 0.2 per cent grade, or a 400-ton train at twenty-one miles an hour on a 0.7 per cent grade. The extra power is provided so that the new locomotives may be used on the future extension of the line on the Italian side, from Iselle to Domo d'Ossola. It is also to be noted that the Simplon locomotives require a high power in order to run against the strong air draft which is produced in the tunnel by the two large fans, and it is estimated

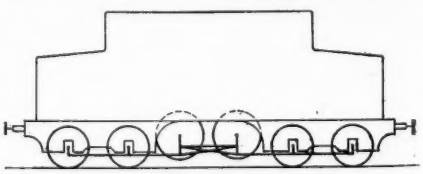


DIAGRAM OF DRIVING MECHANISM OF NEW LOCOMOTIVE.

an additional 700 horsepower is needed for this reason alone, that is, when the locomotive is running against the air current.

The principal data for the new locomotive are as follows: Wheel spread, 4.60 metres; distance between outer axles,

1.70 metres; between buffers, 11.64 metres; weight upon each axle, nineteen tons; total weight, seventy-five tons, including mechanical part thirty-six tons and electrical part thirty-nine tons.

A departure from the usual practice in three-phase working for electric locomotives consists in the use of a squirrel-cage armature for the motors. Hitherto it does not appear that such armatures have been employed in traction motors except for those of comparatively small power. M. Aichele, one of the leading engineers of the Brown-Boveri firm, has been able to design a three-phase motor which gives as high as 850 horsepower, and there are several advantages connected with the use of such motors for electric locomotives. In designing the new motors it was desired to retain the two standard speeds of forty-two and twenty-one miles an hour, seeing that the former locomotives are designed for these speeds. The new motor also has two other speeds of thirty-two and sixteen miles an hour. It uses in the first place a pole change in the stator which gives either six or twelve poles, and, by switching over, twelve poles may be obtained. The rotor being of the squirrel-cage type, will work with any number of poles in the stator, so that a second pole combination which gives eight and sixteen poles may be employed. Such could not be done in practice with the other type of rotor, as in order to have four different pole changes at least ten collector rings on the rotor would be necessary. Such could not be used for different reasons, as will be apparent, so that the old motors were limited to the two running speeds of forty-two and twenty-one miles. Using the second pole combination the locomotive may be run at two other speeds, namely, thirty-two and sixteen miles an hour.

Using the two different windings on the stator, these can be connected in parallel when running, so that a great torque is secured in this way. The use of the squirrel cage brings about a difference in the method of working, as in this case it is not desired to put the full voltage on the motor, owing to the fact that the short-circuited rotor would cause too sudden a demand on the supply mains. For starting the motor there is used a transformer which has different sections, so that the motor is started on a lower voltage, this being then raised by degrees up to the standard voltage. Each of the two motors with its transformer, switches and other apparatus, makes a distinct set, so that the locomotive can be run independently if need be from one of the motors, the other being thrown out. As before, the overhead line uses a double wire with 3,000 volts and sixteen cycles, and this current is taken into the locomotive by the two bow trolleys on the roof of the locomotive.

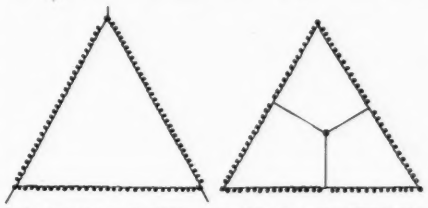
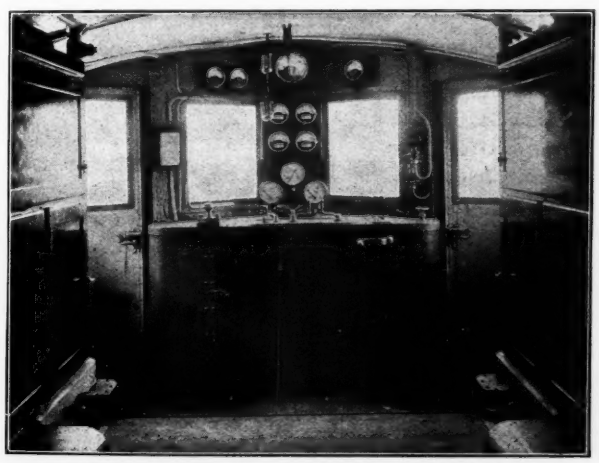


DIAGRAM OF SIX-POLE CONNECTION. DIAGRAM OF TWELVE-POLE CONNECTION.

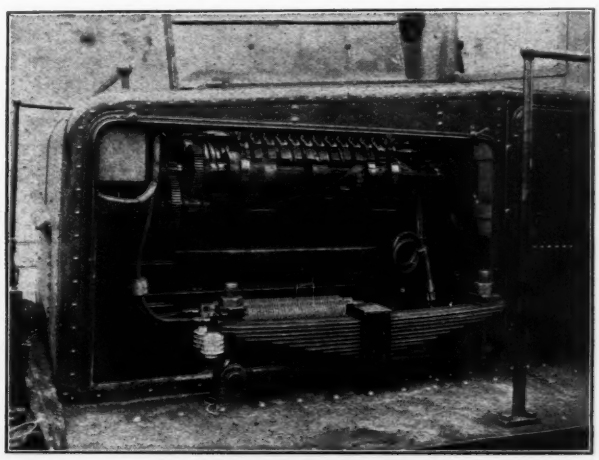
The transformers are mounted in the ends of the locomotive and are provided with ten steps in the winding. The first step gives 1,000 volts for starting the motor, and each of the succeeding steps gives 200 volts additional, so that the voltage can be increased gradually up to 3,000 volts. Beside the transformer is mounted a drum for contacts worked by chain drive from the motorman's bench.

From the transformer the current passes first into the reversing switch, and this is used to change over the direction of the current on the two overhead phases so as to run the motor in either direction. The pole-changer consists of a set of two switches. One switch makes connection for the six-twelve-pole combination in the stator, and the second switch gives the eight-sixteen-pole arrangement. A pneumatic control is used with the reverser and the pole-changer, and these are controlled from the motorman's bench, at which point the valves are located.

There is a similar bench at each end of the locomotive, and the pneumatic devices are symmetrical. In connection with the pole-changer there are used two circuit-breakers which work on overload current in the usual way, so that a fault can be located in any of the four circuits of the locomotive, there being one pole-changer for each motor and each pole-changer having two switches. Such circuit-breakers can also be used as emergency switches and can also be operated by hand from either of the control benches.



VIEW IN THE CAB OF SIMPLON LOCOMOTIVE.

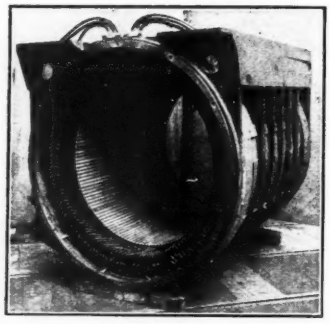


SIDE VIEW OF CONTROLLING APPARATUS.

The pneumatic control of the apparatus is interlocking and all the valves are contained in a small device. This allows the two windings of each stator to be thrown on at once when it is desired to run the two windings in parallel, but it is impossible to put on both the pole-changes of one winding at the same time, as, for instance, the six and twelve-pole.

In order to start the locomotive under these conditions, the motorman receives advice from the conductor of the train as to the probable weight of the train, and he then puts on the transformer controller to give the voltage which is the best for starting up in the shortest

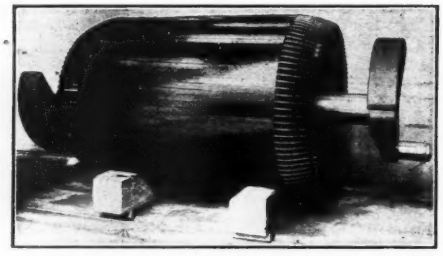
time. Then he throws the reverser in the proper direction for running the locomotive. Lastly, he closes the two switches of the pole-changer so as to put on the sixteen and the twelve-pole windings in parallel. Should the torque not be enough for starting and accelerating, he raises the voltage on the transformer up to 3,000 volts. Then he throws off the sixteen-pole winding, and the locomotive is brought up to speed (twenty-one miles an hour in this case) by the twelve-



STATOR OF PROPULSION MOTOR.

pole winding alone. Should it be desired to run at a higher speed, the motorman goes back on the transformer by several points and then switches the eight-pole winding in parallel with the sixteen-pole winding. He then runs up on the transformer to the full voltage, and after this cuts off the twelve-pole winding. In the same way he recommences the operation in order to use six poles or to bring the locomotive to the highest speed of forty-two miles an hour.

For stopping the train, the voltage is regulated down to 1,000 volts at once



ROTOR OF PROPULSION MOTOR.

and the pole-changer which had remained closed is opened. The reverser is then put to the zero or middle point. This is the usual method. In case of a quick stop, the emergency switches (circuit-breakers) are operated so as to cut off both motors by opening the pole circuits. Both trolleys can also be lowered from the wire by the use of a single pneumatic switch provided for this purpose. The current taken by the motors at the starting is from one to one-and-one-half times the standard current. The efficiency in this period is from sixty to eighty-five per cent and the phase difference 0.5 to 0.8. Instruments mounted upon the bench allow of making the readings for each motor and also for the two motors together, so that the running of each of the motors as to yield and phase difference may be observed.

The illustrations given herewith show the stator and the squirrel-cage rotor. In the present design care was taken to secure a well-closed stator and an open and well-cooled rotor. The rotor spider as well as the end plate and body are of cast-steel and have a simple form, being strong and at the same time of light weight. A new end plate of star-shaped appearance is used in order to give a good air supply to the rotor. The outer rim of the end plate has a turned fit in the end of the stator casting, and thus gives a good protection to the ends of the stator coils. Self-oiling bearings with two rings are employed here. Two separate windings are used for the stator, employing lathe-wound coils laid in slots, with good insulation. This latter is tested at 10,000 volts and is found to hold up very well in the usual running. The slot is closed over by a wood strip.

The trolley of the new locomotive differs somewhat from the usual type, as will be noted. It is made up of two long arms connected by a cross end piece, and on this is swung a short bow-piece, which comes under the trolley wire. There are two separate bows for each trolley, one for each overhead wire, and the two bows are independent of each other, being turned by a spring, cable and chain device. When running, the long arms keep fixed and the small bows are made to bear on the wire by springs. When these springs are near their limit, the springs of the main arms come into use automatically. The cross-bar which takes the friction on the trolley wire is formed of a brass rod of triangular section which is mounted so as to turn about its axis. By turning it occasionally by hand, the wear of the surfaces is equalized. These surfaces are also occasionally greased. It is found that the wear of the trolley wire itself is quite small, this being 0.12 millimetre on an eight-millimetre wire in the space of two years.

Seeing that the question of the use of two three-phase locomotives on the same train has been a somewhat disputed one, it is of interest to note the tests which were made by the Federal railroads with the use of the two new locomotives on the same train. In some cases a light and in others a heavy train was used. The tests were made at different speeds. It was found that the two electric locomotives could be run together in a very satisfactory way, placing them both at the head of the train, or again using one at each end. Furthermore, one of the new locomotives could be used with one of the old ones, in spite of the differences of wheel diameter and other differences of construction, and the train could be run very well under these conditions.

Sale of Tarrytown, White Plains & Mamaroneck Railroad.

Richard Sutro, of Sutro Brothers, representing the New York, New Haven & Hartford Railroad Company, purchased the greater part of the Tarrytown, White Plains & Mamaroneck Railroad, for $825,000, under a $500,000 foreclosure sale brought by the Knickerbocker Trust Company.

The line was sold in three sections, the first two of which were bought by Mr. Sutro. Section one extends from Mamaroneck to Tarrytown, a distance of sixteen-and-one-half miles, and was bought for $460,000. The other New Haven purchase has a route from White Plains to Scarsdale, a distance of five miles, and cost $365,000. Section three, extending from Mamaroneck to Larchmont, a distance of two miles, sold to Frederick J. Littlebrook, for $110,000. Mr. Littlebrook represented Franklin L. Babcock, secretary of the bondholders' committee of the Third Avenue Railroad Company.

Electric Tunnel Locomotive for Pennsylvania Railroad.

The first of the 4,000-horsepower electric locomotives has been delivered to the Pennsylvania Railroad and is now in operation in the Pennsylvania tunnel at New York city.

This locomotive is driven by a single motor, weighing 45,000 pounds, which is the largest railway motor ever constructed. The principles of construction of this locomotive are very similar to those of the locomotives used on the Simplon Tunnel, a detailed description of which appears in this issue.

Bonds Authorized for Brooklyn Subway.

At a recent meeting of the Board of Estimate and Apportionment a bond issue of $2,850,000 was authorized for the commencement of work on the Fourth Avenue subway. While the entire project will cost nearly $16,000,000, it is believed that this amount will cover a year's work.

Single-Phase Electric Road in Norway.

A single-phase electric railway has recently been installed in Norway by the British Westinghouse Company. This road, which is the first of its kind to be installed in that country, connects the cities of Thamshavn and Lokken. The line runs through the valley of the River Orkia and will do much toward developing the rich ore deposits there as well as to deal with a rising tourist traffic.

The power for the line, as well as for the town of Thamshavn, the various villages along the line, and for the mines at Lokken, is derived from a waterfall near Thamshavn. The current is generated and conveyed to the various towns at a three-phase supply at 15,000 volts, fifty cycles, while the power for the railway line is converted into a single-phase supply at 6,000 volts, twenty-five cycles, by means of motor generators, in a substation at Thamshavn. This substation forms part of the main station and contains two 250-kilovolt-ampere motor-generator sets, with room for a third set, as well as for three oil-cooled three-phase, 15,000-6,600-volt transformers of 250 kilovolt-amperes each. The motor-generators each consist of a three-phase, 6,600-volt, fifty-period induction motor with slip rings direct-coupled to a 6,600-volt, twenty-five-cycle, single-phase generator.

The trolley wire voltage is automatically controlled by a Tirrill regulator. The road is single track, of one meter gauge, and is on the whole, very level and free from curves, though at one point grades up to four per cent exist. The trolley wire has a catenary suspension, and is divided into six sections by section insulators, which are normally short-circuited, but can be opened by means of a long pole when necessary.

The rolling stock consists of three locomotives, one saloon motor coach, four passenger coaches, and twenty-one freight cars. Each locomotive weighs twenty tons, and carries four motors, two on each truck. Each can exert a draw-bar pull of 6,600 pounds at a speed of eleven-and-one-quarter miles per hour. The four motors are used in two groups of two in series.

It is reported by an American consul that the Chilean Government is actively studying the electrification of the first section of the government railways from Valparaiso to Santiago, a distance of about 115 miles.

United Power and Transportation's Affairs.

The United Power and Transportation Company has filed in the Court of Chancery at Trenton, N. J., its answer to the suit instituted against it by Edward J. Moore, a Philadelphia banker, to enjoin the plan of reorganization proposed by the Interstate Railways Company, which latter concern owns 143,683 shares of the total stock issue of 143,750 shares of the former company. Mr. Moore charged that the reorganization plan was intended to work out to the benefit of the Interstate Company at the expense of the United Company. The answer denies that such would be the result of the plan, and sets forth that the properties controlled by the United Company are badly in need of betterment, and that the reorganization plan would provide funds to accomplish this.

The answer makes the charge that Moore's suit was not instituted in good faith, but that it was done with the purpose of forcing the foreclosure of the Interstate Company's properties in order that he and his associates might gain control of them.

The reorganization plan proposed involves the issuing by the Interstate Company of not more than $1,500,000 of six per cent scrip and the pledging of the stock of the United Company for the payment thereof, the money thus obtained to be used for the betterment of the United Company's property and the payment of interest on Interstate Company's bonds.

The United Power and Transportation Company owns and controls the Trenton Street Railroad Company.

Electrification Opportunities in Latin America.

An American consul in Latin America has forwarded a translation of an article published in a newspaper in his district covering a report made by a government commission appointed to study the electrification of the railway lines in that country. The consul states that it is an important undertaking, since it covers the beginning of extensive improvements that mean much to the industrial advancement of the country. If it is successfully carried out it means an opening for large quantities of electrical machinery within the next few years. Copy of the report can be obtained upon application to File No. 3990 at the Bureau of Manufactures, Washington, D. C.

Queensboro Bridge Line.

New York Public Service Commissioner Bassett conducted an investigation recently as to the right of the New York & Queens County Railroad Company to operate cars over the Queensboro Bridge. This company was refused a franchise last summer by the Commission on the grounds that it would have a fifty-year monopoly. After several months' delay a temporary grant was received from the Board of Estimate and Apportionment, James L. Quackenbush, counsel for the company, maintaining that that board had the right to authorize a permit for operation over its own property.

In opening the case Commissioner Bassett stated: "There is no question of the desirability or even necessity of this operation. The Commission is as anxious as the citizens of Queens County that the Queensboro Bridge shall be utilized for passenger traffic, but it will insist that the operation be carried on according to law. If illegal operation can be begun on desirable routes then the entire subject is in chaos, and we might as well go back to the old method when possession constituted nine points of the law, and the corporation that laid its tracks by force would succeed in carrying on transportation in the public streets."

Accidents on New York Railways.

The various traction and railroad companies reporting to the New York Public Service Commission for the First District have submitted the following list of accidents on their lines during the month of September, with comparisons:

	1909.	1908.	1907.
Total accidents	4,638	5,023	5,202
Killed	27	34	63
Seriously injured	199	276	153
Other injuries	2,827	2,900	.....
Total injuries	3,053	3,210	.....

Comparisons for injuries in 1907 are lacking, owing to a different form of report in use at that time.

Aerial Tramcars.

It is reported that a company has been formed in Vienna to exploit a system of aerial tramcars which has been invented by Captain Quoika, an Austrian aeronaut. High-tension electric cables will be laid on the ground, and airships will be connected with them by means of other cables, which will take the place of the trolley in the ordinary overhead tramcar system. Power will thus be supplied for driving the propellers of the airships, and, in addition, the airships will be kept on their right course and at a fixed height of 300 feet.

ELECTRICAL Advertising *and* Selling

GETTING BACK TO FIRST PRINCIPLES.[1]

BY C. A. PARKER.

Henry Ward Beecher was once approached by a timid but ambitious young clergyman and asked along what lines he was in the habit of preparing his sermons.

"Well," said Beecher, "first I tell the people what I'm going to tell them, then I tell it to them, and then I tell them what I've told them."

Central-station advertising may be said to have reached the stage where the advertiser must "tell the people what he has told them." To a very large extent, the problem has become one of "singing the old song" in a new way. And the chief difficulty lies, not in the theme itself, but in composing a melody and words that will score a hit in spite of the number of times the subject matter has been repeated.

To use still another figure of speech, the whole situation is very similar to the difference between cultivating virgin soil and the tilling of well-worked ground. When the field of possible new business is still untouched, the central-station man reaps rich harvests by merely sowing the seed of advertising in a lavish and indiscriminate manner. But this sort of treatment cannot last. The soil becomes more or less overworked and refuses to bear fruit. Indeed, many central stations, especially those located in districts that are not growing rapidly, have experienced considerable alarm upon finding traces of this approaching "sterility" and for that reason have ceased aggressive advertising.

That such a course of action is mistaken is readily demonstrated by those central stations which have gone on with their advertising in the way that the farmer tills well-worked ground—*intensively*.

INTENSIVE ADVERTISING.

Intensive cultivation means nothing more nor less than scientific cultivation—nursing the ground along, returning to it in one way what has been taken out in another, letting it rest at times, and keeping constantly in mind the fact that future harvests must not be sacrificed for a present gain by wasteful methods. Central stations must advertise as extensively as ever before, if not more so. But it must be advertising of a much higher grade and more attractive character than sufficed in the early days. It must be scientific in the real sense of the word—"based upon accurate, systematic knowledge."

Fortunately, the very conditions which have made this sort of advertising necessary have also made it possible for such advertising to be produced. Advertisers in this line of work have been attending the school of experience. Mistaken ideas, the product of unchecked enthusiasm, have been shown up in their true light. Whatever has proved itself to be of lasting effectiveness has been culled out and preserved in a hundred different forms. Central stations in various parts of the country have contributed much that can be made use of by other companies. One has only to go to the literature on the subject to find a wealth of suggestion and advice.

This last consideration has had much to do with fixing the writer's determination to devote himself for the most part to outlining the fundamentals of successful central-station advertising, using actual suggestions more as illustrations incidental to his main theme.

In no field is there as great a danger of wandering from the real purpose as in advertising. And in no other field is wandering quite so costly. With this in mind, a frequent harking back to first principles is the greatest possible safeguard against misdirected advertising. If we constantly remind ourselves that the shortest distance between two points is a straight line, we are not apt to go after things by some zigzag route.

ADVERTISING IS SALESMANSHIP.

Advertising is salesmanship. To try and reduce it farther by a still finer qualification than this is as futile as trying to solve the ultimate unity of the universe. Some call advertising "news"—business "news"—and justify themselves by pointing to the Latin source, from which it is derived—*ad-verto*—to turn to or to bring to the attention of—to make known. Advertising *is* news. But it is news with a purpose, and that purpose is to sell goods or to help sell them. If advertising does not sell goods it has no right to existence. What we say about advertising in general applies to advertising electricity in particular.

Advertising electricity is nothing more nor less than selling electricity. If your advertising doesn't sell it, it simply should not be. But that it should *sell* electricity is not enough. If the same amount of business could be secured more cheaply or more effectively in some other way, then advertising is still without an excuse for existence.

CENTRAL STATIONS MUST ADVERTISE.

It will need no argument, however, to establish the right of advertising to a place in the realm of getting new business for the central stations. Experience shows readily enough that, when good, advertising not only does get the business but gets it at the minimum expense. Nor does its usefulness end here. Advertising is not the competitor of the solicitor, as some seem to think, but his strongest ally. Without it, the cleverest agent must necessarily find his road anything but a primrose path of dalliance. Not only does good advertising go before him and break down the barriers of indifference and prejudice, but it keeps prospects who are precariously balancing on the fence from falling off in the wrong direction. It stirs up new inquiries for him to close up and, if regular, keeps interest in electricity simmering instead of allowing it to grow cold. Central stations must advertise. There is no way of dodging the issue. If they do not advertise, they do not sell as much of the commodity they handle as they should. Because advertising is salesmanship.

KNOWING THE GAME.

Every good salesman must know his proposition from A to Z. So must the central-station advertiser. Now—although it may seem a good deal like going back and reciting the multiplication tables—let

[1] First of a series of articles on advertising electricity by this well-known advertising expert.

us ask ourselves, what sort of a proposition is it anyway that the central-station man has to handle? From the salesman's standpoint—the standpoint of salability—is it a good, bad, or indifferent?

As a matter of fact, the writer can think of no business in which the possibilities are so great as in the electrical business.

In the first place electricity has the widest possible appeal. It has something for everybody. It has revolutionized the home from top to bottom, making housekeeping devoid of drudgery. It plays a vital part in every hospital. Commerce and industry would be lost without it. Even the pleasures of life are enhanced by its existence, and it all means a steady flow of golden hue into the coffers of the central-station man. With this range of activity, there must surely be something wrong with the electrical advertising that is not effective.

SOME DRAWBACKS.

There are, to be sure, certain drawbacks. Public sentiment is not always favorable to public service corporations, and while affairs are not as bad as they used to be, there is still a large percentage of the population of the ordinary city which dreads the idea of making monthly contributions to any "bloated monopoly." This last suggests another drawback that the central-station electrical advertiser must confront and overcome. And that lies in the character of the commodity offered. The central station has for sale an intangible service appreciated chiefly when a person used to its advantages must, for some reason, do without it. The variable nature of the cost, although it depends on the user, is another explanation for much hesitation.

These things, together with the difficulty that every advertiser and salesman experiences in getting people to change from the old to the new, constitute the central-station advertiser's problem. *How is he going to solve it?*

WANTED—COMMON SENSE.

Some electrical men seem to feel there was a mysterious element in their business that calls for some occult faculty or divine gift on the part of the man who does the advertising. Nothing could be farther from the truth. The same principles apply to the advertising of electricity that apply to the successful advertising of any proposition. And these principles can be boiled down to a generous application of common sense to the problems in hand.

HARMONY OF INTERESTS.

The interests of the company are the interests of the people. This is a fact that only the narrowest minds inside or outside of the company cannot see; and you cannot play upon it too strongly. As evidence of its good faith, the company should admit the public into its own family circle, so to speak. There are few of the company's activities that cannot be explained and justified by a good, square reason. Tear away the veil of secrecy that too often veils the creation and distribution of electricity. Take the public into your confidence as much as possible. It pays.

BE BOOSTERS.

If a central-station advertiser follows this policy, it will not be very long before he will find his company at the van of the town's organized "boosters." If it is not there, somebody should inquire into his fitness for his position. Remember, the louder you yell for "a brighter, bigger and busier Blankville," the louder you are yelling for a more prosperous and progressive company.

PLAY UP THE LOCAL EVENTS.

Don't let the people forget for a single minute that when it comes to the town's welfare, you're right there all the time. Use every local event of any importance at all to bring the company into the limelight.

Steps like these have succeeded in carrying more than one company into more general favor; and when they do, the obstacles that lie in the character of the proposition itself are soon overcome.

SIMPLIFY YOUR CONTRACTS.

But this is by no means time for the advertising to fall off. It should be brought into play with greater force than ever. Every effort should be bent toward clearing up any doubts that may cling to the minds of the prospects. You have still to overcome the natural fear of signing contracts that possesses the human mind—especially when it is the mind of a person inexperienced in commercial transactions. That this fear does keep people away from you is clearly shown by an actual case. A certain company found that new business was conspicuous by its absence. What was more, it didn't seem to be able to stir any up. Then some bright mind conceived the idea of stripping its contract of its superfluous verbiage and its mass of legal technicalities, and reducing it to a simple, easily understood agreement. The result was little short of marvelous. Business increased with astonishing rapidity.

SHOW THEM THAT IT'S EASY.

Another thing that cannot be forgotten is this, the uninitiated almost invariably imagine that installing electricity in their homes is practically equivalent to building a new house. They magnify the work required, the money necessary, as well as the size of the bills, far beyond all reason. If your advertising keeps silent on the matter they will take their own ideas as correct. Make it a cardinal principle to clear up every point upon which there could be the least doubt in the minds of the prospect. This is one reason why outside advertising assistance is often essential. The man in the office is too close to the matter to view it with the eyes of a "layman." For this reason many things that are clear as crystal to the central-station advertiser are vague mysteries to the outsiders.

MOVING THE INERT.

When you have won the favor of your prospective customers and overcome any doubts that may be holding them back, you have reduced your advertising problems to that of any advertiser with a commodity to sell. You must induce the people you are after to change from the old to the new.

You probably remember when you began your study of physics, you were taught the principle of inertia. Bodies tend to remain in the condition in which they happen to be. So with people. Get them started once and they come. But the difficulty lies in getting them started. Naturally you get the progressive first. They make up the body of people upon which you can depend for regular business and regular growth. For anything over and above that you must look to the "slow pokes."

So there is no reason for being discouraged or discontented when you find that it takes continual "hammering" to get them started. They will awake in the end to the value and economy of electricity. And you will reap the benefit.

THE MEANS AT HAND.

Now, having the "ends" of central-station advertising in view, the "means" to the "ends" become of first importance. In general, every available advertising medium should be used to a certain extent. Billboards, street-car cards, and newspapers for general publicity purposes. Bulletins of a general nature can be made through the press, the space

used serving the double purpose of making the announcement and keeping the newspaper talk along the right lines. Display rooms in the company home, decorated windows, street "stunts," etc., all play an important part.

But the bulk of the work must be done through the mails. Because, for the attainment of the purposes we have mentioned, this is the most effective form of publicity possible.

THE DIRECT APPEAL.

In the first place, the direct appeal is a personal appeal. It is secondary only to an actual interview, and, indeed, is without some of the disadvantages of the latter. It brings the company and the recipient face to face, so to speak. But there are even more weighty reasons than this for "letting mail advertising do it."

The appeal of electricity varies. What interests the housewife is quite foreign to the merchant who ought to have a sign. To get these different classes with newspaper advertising, for instance, would require at least four advertising appropriations. Mail advertising does the entire work for less than what a single effective newspaper campaign would cost. Furthermore, mail matter brings the advantages of electricity to the prospect when he or she is in the very midst of the conditions which electricity improves. An advertisement for a flat-iron catches the housewife when ironing problems are occupying her mind. The power advertisement may come into the office together with a complaint about the engine, and so on.

But there is one thing upon which the success of all electrical advertising depends. And that is the spirit behind it. Lackadaisical indifference is fatal. It must be the superior product of heart and brain. It must bristle with common sense, sincerity, enthusiasm, persistency, and force. Without these, a campaign is perfunctory and of little value.

The writer is constantly impressed with the need for the *best* work in advertising electricity—the best "copy"—the best illustrations—the best forms of pamphlets, letters, circulars and mail matter generally, because, surely, such good things as electrical comfort and health and convenience are worthy of at least as good present action as any other commodity.

And—in these days—many of the other commodities are educating the public to pay but scant attention to half-baked, poorly-printed, ill-thought-out advertising matter.

A Unique Manner of Interesting Central-Station Customers.

On other pages of this issue appears a report of a dinner given under the auspices of the Grand Rapids-Muskegon Power Company to the manufacturers of Grand Rapids and vicinity. Invitations were sent to many manufacturers, and the large number of those who accepted was a pleasant surprise to everyone concerned. The main topic of this occasion was factory lighting and prominent speakers were present who gave practical and instructive talks on the subject. The banquet room was artistically decorated, a sumptuous repast was served, and as a whole the affair was voted an unquestionable success.

As the object of the central station is to sell current, it follows that anything tending to that end is of value, if the expense is justified by the result. Advertising experts throughout the country in discussing central-station advertising and methods of securing new business, emphasize the subject of co-operation and harmony between the company and the customers. It is also conceded that a satisfied customer is one of the best advertisements.

This meeting, then, in Grand Rapids probably marks a new era in central-station advertising. It showed that the manufacturers of that city were willing to co-operate with the central station for the betterment of factory illumination. Incidentally, numerous types of lamps were used in connection with the electrical decorations, and these undoubtedly created an impression, the results of which must surely be felt in the near future. However, the results of the address on factory illumination were in evidence immediately following the close of the meeting, and it is safe to prophesy that the results of this dinner will more than justify the expenditures it involved. The Grand Rapids-Muskegon Power Company has set an example that should be followed by other central stations.

While the revenue of the company may not be immediately affected as a result of this dinner, the good feeling it created in showing an impartial interest in the welfare of the manufacturers' interests will have its good effects.

Lighting and power companies in other sections of the country could hold such banquets to their great advantage. They should strike while the iron is hot. Just now the tungsten situation offers an opportune time for the central station to talk superiority and low cost of operation, and the gas companies cannot follow them. It would be difficult for a gas company to give such a demonstration. The cost of piping a large room for individual gas mantles to prove equal distribution of light would be prohibitive, if it were possible even to demonstrate by gas. Arguments against distribution of gas light in factories by individual burners would defeat the purpose of the demonstration. If a gas company were to try such a demonstration they would have to depend upon electric lamps for table decorations. There are so many arguments to prove that a gas company cannot compete with electric companies at the present state of the art, that it is wise for the lighting and power companies to take advantage of the opportunity now before them in the matter of tungsten lighting and demonstrations thereof. Another advantage for the electric company that does not pertain to gas companies, namely, the electric company is after the factory power, and the expense of such a banquet, as well as the expense of the demonstration, would be well warranted because of the prospective power business.

An Electric Humidifier.

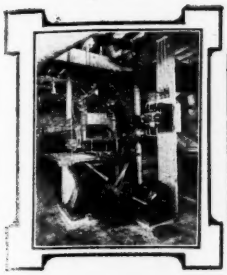
The Indiana and Michigan Electric Company, of South Bend, Ind., recently canvassed the tobacco stores and cigar stands for the purpose of explaining how an eight-candlepower carbon lamp sealed with a waterproof socket and immersed in a jar of water would prove a much more efficient humidifier than an ordinary sponge. It suggested the use of a cut-glass globe and tinted water to give a decorative effect, and the cigar men were very enthusiastic. It was new, and saved the trouble of wetting the sponge. This idea was worth many dollars in kilowatt-hours of current consumed.

Timely Advertising.

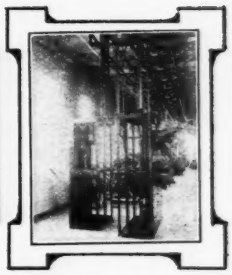
As previously mentioned, the Denver Gas and Electric Company, Denver, Colo., is distributing a series of monthly calendars containing a timely advertisement and illustrated by prominent artists.

The November calendar, just issued, is in keeping with those previously distributed and will undoubtedly be accorded the same complimentary reception. Advertising of this kind is sure to have its effect.

Generally speaking, the people know a great deal already, but the main business of the advertiser is to keep on reminding them of what they already know.



Industrial Power



INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.—IV.

BY C. E. DANIELS.

GENERAL INSTRUCTIONS FOR DIRECT-CURRENT MOTORS.

Starting.—All direct-current motors above the very small sizes are started by first giving the shunt field full excitation and then connecting the armature, with a starting resistance in series, to the circuit. The resistance is then cut out in steps as the motor speed accelerates, the time required to attain full speed varying approximately from fifteen seconds for small motors to one minute for very large sizes. These limits should be used with discretion, since more time is required to start with heavy torque than with light torque.

On request, connection diagrams and instructions can be obtained from the manufacturers of almost any starting or controlling device. After all connections are made according to instructions and all mechanical preparations are complete, see that all the field adjusting resistance (if used) is cut out and that the starting resistance is all in circuit. Close the circuit-breaker (if used), then the line switch, and lastly cut out the starting resistance step by step, as instructed, allowing enough time for the motor speed to accelerate smoothly. Too rapid starting results in excessive starting current and possibly flashing at the brushes. Every caution in regard to mechanical operation must be observed in starting. The motor should generally start when the armature circuit is first closed through the starting resistance, and failure to start when the second or third step of resistance is cut out is a signal to open the line switch or circuit-breaker at once and find the cause of the failure.

Stopping.—Never move a starter or controller handle to the off position under any circumstances if by so doing the shunt-field circuit of the motor is opened. The high induction of the motor field may generate electromotive-force enough to puncture the insulation. If necessary to open a shunt-field circuit it should be done slowly by a knife switch, allowing the field current to die out, owing to the resistance of the arc across the switch terminals. A better method is to install a field switch where such a necessity may occur. Several good types of field switches are available, by means of any of which a circuit is closed through a discharge resistance before that through the field is opened. If the starter or controller is provided with a low-voltage release, the line switch or circuit-breaker should always be opened first for stopping; the motor speed will then decrease until the starting resistance will be automatically cut into circuit.

FIG. 20.—DIRECT-CURRENT MOTOR DRIVING MOLDER AND PANEL RAISER.

Brush Adjustments.—The neutral no-load position of the brushes on all good modern motors having adjustable brush holders is marked on the rocker ring or movable portion and on the frame or bearing, so that the neutral position is easily found if the brushees are moved away from it. With the brushes set at the neutral point the motor should run practically without sparking from no load to full load in either direction of rotation; that is, the motors are suitable for reversing operation. If only one direction of rotation is required, and if the motor is to be overloaded, the brushes should be shifted slowly backward opposite the direction of rotation to the point where slight sparking begins at no-load. Sparking at the brushes when the motor is operating with load can frequently be entirely removed by shifting the brushes slowly from or toward the neutral point. In any case the correct distance of the brushes from the neutral point is very slight, and the movement should be made with great care, since too much movement will cause violent sparking.

Care of Commutator and Brushes.—Carbon brushes are almost invariably used on modern industrial motors. The chief considerations in caring for such motors are to keep the commutators clean, the brushes properly adjusted, and the brush contact surface good. The last condition, once fulfilled, will usually take care of itself until the brushes are worn out, provided the other conditions are complied with. At intervals, depending on the service and the location, the commutator contact surface and end should be thoroughly wiped with clean canvas free from lint. A few drops of oil on the cloth or a piece of paraffine rubbed lightly across

the commutator surface will give all the lubrication necessary. Lubricant should be used very sparingly on a commutator and no grease, oil or dirt should be allowed to accumulate on the commutator or the brushes.

The ideal appearance of a commutator surface is polished dark brown or choco-

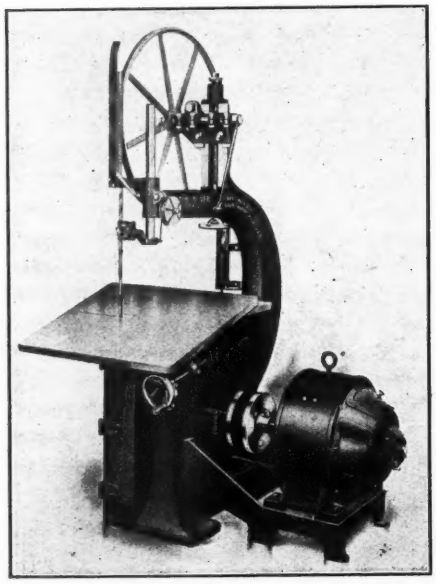


FIG. 21.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO BAND SAW.

late color, and when the commutator is rotating slowly in starting and stopping the brushes squeal sharply. Such a commutator needs no attention other than cleaning when necessary. If the surface has a raw copper color, with gradual roughening, it should be smoothed with sandpaper, or, if very rough, with a piece of sandstone; emery paper or cloth should not be used for this purpose. The sandpaper should be held against the commutator by means of a block having the same curvature as the commutator. The sandstone likewise should be curved to fit the commutator.

Grinding in the Brushes.—When making proper contact with the commutator, the face of the brush is glazed. If the glazed portion does not extend over very nearly all of the brush face, the brushes should be ground in by wrapping a long strip of sandpaper closely around the commutator with the rough side toward the brushes and then rotating the commutator and the sandpaper slowly through one or two revolutions. Shorter pieces of sandpaper held close to the commutator surface and drawn a few times back and forth under each brush or set of brushes will answer the same purpose.

Sparking.—With the proper installation, operation, and care a well-made direct-current motor will seldom give serious trouble from sparking at the commutator. If sparking does occur it is probably caused by some one or more of the following conditions, the remedy in each case being either obvious or suggested. The causes are numbered in the order of their probable occurrence. Remedies for causes 6, 7, 8, 9, 11 and 12 follow under "Repairs."

1. Excessive overload.
2. Improper brush adjustment. (See preceding instructions.)
3. Poor brush contact.

(a) Accumulations of grease or dirt may hold the brushes from the commutator.

(b) Brushes may need grinding to fit the commutator. (See preceding instructions.)

(c) Brushes may stick in the holder; grind or sandpaper them until the movement is free.

(d) Increased brush pressure may be needed; the method of adjustment will be evident.

4. Rough commutator. (See preceding instructions.)
5. Poor connection between the brushes and the holders. See that both ends of the shunts are securely fastened in place. Loose shunts are usually indicated by burned connections.
6. Loose connection of armature lead to commutator bar, indicated by the blackening and burning of this and the adjacent bars. An open circuit anywhere in the armature will cause sparking that seems to encircle the commutator when running, and burn the bars at the point of open circuit.
7. Short-circuited armature coil, indicated by heavy intermittent sparking, burned commutator bars, and excessive local heating, which may be readily found by stopping the motor after running a very short time and feeling the armature surface.
8. Grounded armature coil.
9. Loose commutator bar indicated by slight jumping of the brushes, with intermittent sparking.
10. Unequal spacing of brushes—not likely to occur unless brush holders have

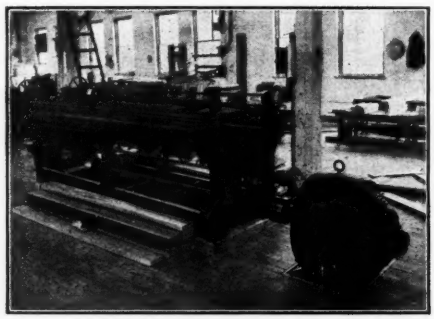


FIG. 22.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO COUNTERSHAFT OF SPINDLE BORER.

been dismantled and reassembled. The spacing can be verified by counting the bars between corresponding edges of the brushes or marking the distances on a strip of paper wrapped closely around the commutator under the brushes.

11. The mica segments and commutator bars may not wear evenly; that is, accumulations of oil or grease may cause the segments to become pitted below the commutator surface.
12. Flat spot, or a "flat" on the commutator, or commutator out of true; caused by rough handling, a bad belt splice, or flashing owing to a short-circuit on the line. A flat or a commutator out of true can be detected by slight jumping of the brushes or uneven motion of the commutator and brushes. These indications may also point to a bent shaft.
13. Bent shaft (for indication see foregoing paragraph). Test by holding a piece of chalk near the shaft as it ro-

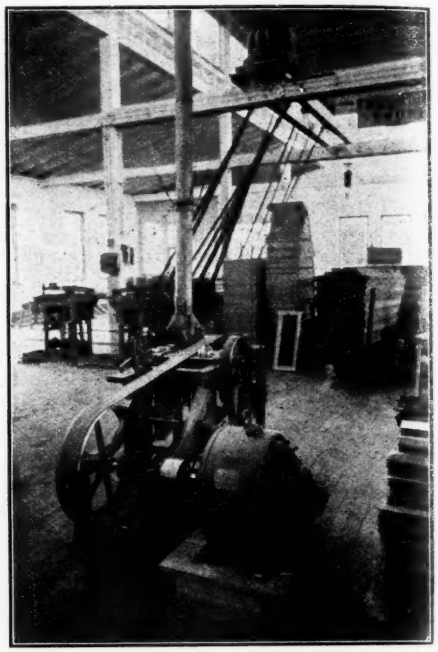


FIG. 23.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO COUNTERSHAFT OF SASH STICKER.

tates in a lathe. Remove the bent shaft from the armature and straighten or replace it by a new one.

REPAIRS.

Field Coils.—An open-circuited shunt-field coil can be detected by touching the terminals of a voltmeter to the terminals of the individual coils while full voltage is applied to the field circuit. The voltmeter will show no deflection until the defective coil is reached, and will then indicate the full voltage.

A short-circuited shunt field can be found by the same test, the voltmeter deflection being least on the defective coil.

A grounded coil can be found by the process indicated in the section of general instructions.

In replacing a field coil make sure that the polarity of the pole differs from that of either adjacent pole. The polarity can be tested with a small bar magnet or a piece of steel wire suspended from its center by a string. In holding the magnet near the poles successively, it should reverse at each pole, *i. e.*, no two successive poles should attract the same end of the magnet.

Armature.—An open-circuited arma-

ture coil not revealed by inspection can be located by disconnecting the upper leads from each burned commutator bar and applying the terminals of magnets or a lamp-testing circuit between each free end and all the other bars. A complete circuit will be indicated with all except the end of the open coil.

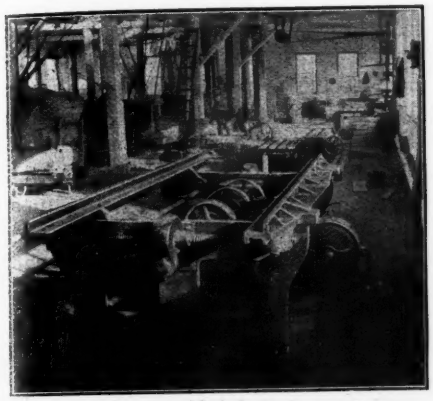


FIG. 24.—DIRECT-CURRENT MOTOR DRIVING DOOR CLAMP.

An open-circuited or short-circuited armature coil can be repaired temporarily by cutting off and taping the commutator lead from the defective coil, fastening it where it cannot injure the other leads, and short-circuiting the bar thus cut out with the next one in the circuit. Great care must be used in applying this remedy, and it should be for temporary purposes only, permanent repairs being made at the first opportunity. In case of a

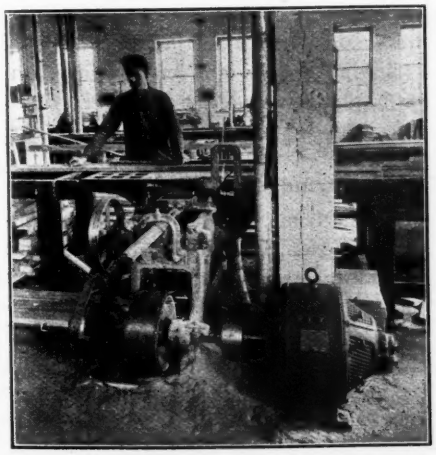


FIG. 25.—DIRECT-CURRENT MOTOR OFERATING CUT-OFF SAW.

short-circuited coil, the removal of a terminal lead from the commutator bar will not always remove the difficulty, but it is necessary to open the coil (or series of coils, in case of a wave or series winding) elsewhere, so as to prevent the short-circuit from causing a burnout. In case of a wave winding, an open circuit will result in burned commutator bars at as many different places as there are pairs of poles.

Commutator.—A commutator with loose bars (high or low) should be removed from the armature and tightened. This process requires the disconnection and reconnection of all the leads, and for best results the commutator should be in a press while the nut is tightened; it is therefore recommended that such work be done in a good repair shop.

Pitted mica segments should be repaired as soon as discovered. Clean the hole thoroughly and fill it with an insulating paste that will quickly harden and that will hold its position when the commutator is warm. The following have been used successfully: Prepared chalk or plaster paris and shellac; water glass and powdered glass. In some cases a portion of pitted segment near the end of a commutator can be cut out smoothly with a hack saw, and a piece of mica fitted and fastened in place by slightly burring the edges of adjacent segments. This burring must not be enough to endanger the short-circuiting of two segments, hence this method of repair should be used with great caution.

CAUTIONS.

Never allow the load to be removed entirely from a series-wound motor while operating, or to be reduced enough to cause a dangerously high speed. Driving by belt with a series motor is bad practice, since belts occasionally leave the pulleys, in which case a series motor would very likely be ruined. The driving connection should be positive and perfectly reliable.

Never open the shunt-field circuit of a motor in operation; otherwise the motor will race and serious damage will result.

When the shunt-field circuit of a motor or a generator is excited, never open it quickly unless a path for the inductive discharge is provided. The circuit can be opened slowly, if desired, the arc at the opening serving to reduce the field current gradually. Only one hand should be used in doing this, all other parts of the body being kept clear of the circuit. Fatal shocks have been received when opening comparatively low-voltage field circuits by holding the two portions of the circuit in the hands, so that the body bridged the opening.

In soldering connections never use an acid that will act on the insulation or the copper; an alcoholic solution of resin is a good non-corrosive soldering flux.

In soldering commutator connections do not allow bits of solder to drop down where they may short-circuit commutator bars.

Keep the commutator and brushes clean and use lubricant sparingly.

Never use emery cloth or paper on a commutator or brushes.

Hydroelectric Plant for St. Lawrence River.

Consul Henry C. A. Damm, of Cornwall, supplies the following details of the plan to develop power in the St. Lawrence River:

The Cornwall Board of Trade has petitioned the Dominion Government to grant a franchise to the St. Lawrence Power Company for utilizing the channels of the river for a hydroelectric plant. This concern, with an associated American company, has already spent $1,000,000 in purchasing sites, etc. The first dam is to be built at a cost of $4,000,000 at the foot of South Sault Channel, where 65,000 to 70,000 horsepower can be developed. Later another dam is to be constructed at the foot of Sheeks Island, on the Canadian side, and finally, when needed, a dam at the foot of Barnharts Island, across the main channel of the St. Lawrence. At dam No. 1 a lock is to be erected by which the vessels can overcome the whole forty-foot fall of the rapids in one lift, whereas now six are required in the Cornwall Canal—which, however, would not be interfered with. A saving of five hours would be effected.

The company proposes to erect power transmission lines from Cornwall to Brockville, and to supply all demands for power in this section. As yet there is not sufficient demand to warrant large expenditures of money, and the projectors are urging the communities along the line of the proposed development to induce manufacturing plants to locate here.

Developments at Panama.

The first of the three turbo-generators at the Miraflores power station, Canal Zone, has been completed, and was given its preliminary trial on Saturday, October 2 last.

This has been operated at intervals since, and as soon as some insulation troubles are cleared, will be ready to furnish current. Two wires have been strung on the transmission line to the Pedro Miguel Locks, and work will shortly commence on the new substation at that point, which is to be equipped with two 500-kilowatt converters.

CAUSES OF BREAKDOWNS IN ELECTRICAL MACHINERY.—I.

A BRITISH INSURANCE COMPANY'S REPORT.

The report of Michael Longridge for the year 1908 to the British Engine, Boiler and Electrical Insurance Company, Ltd., which has recently been published, contains in his observations on the causes of breakdowns in electrical machinery which came under the notice of the company, many interesting lessons to the electrical world in general.

Two cases were given illustrating the danger of leaving small pieces of iron or steel near dynamos or motors, especially those of open type, with stray fields unscreened by iron or steel casings.

In the first of these the damage was caused by a small tapered pin belonging to the engine of a two-pole, underhung, direct-current, open-type dynamo. The engine had just been overhauled, and the pin, which had evidently been laid down on or near the dynamo, was attracted into the space between the armature and the pole-faces when the magnets were excited. Four of the armature bars were cut almost in two, the end connections to six others were bent, and the installation was torn off all around the engine end of the armature.

In the second case a "nailing-machine" was coupled by gearing with a two-pole, semi-enclosed, shunt-wound, two-horsepower motor running at 1,300 revolutions a minute and taking current at 250 volts. One of the nails must have fallen into the casing and, being caught in the stray field and drawn in between the armature and a pole-face, thereby short-circuited some of the armature conductors. The damaged conductors had to be entirely rewound.

An electric-driven centrifugal pump placed in a chamber hewn out of the solid rock in a coalpit was the next typical instance cited. The cause of the trouble in this case was a loosened plug in the pump casing, which permitted a jet of water to saturate the entire motor and thereby earth three of the stator coils.

Two examples were given which showed the importance of attention to lubricating oil wells.

The first case was that of a machine belt-driven by a direct-current, five-horsepower, four-pole motor running at 700 revolutions a minute and taking current at 220 volts. The armature shaft was carried in phosphor-bronze bearings and lubricated by rings running in oil wells fitted with drain-cocks having handles cast with the plugs. The belt seems to have run to one side of the pulley, caught the handle of the drain-cock, and knocked it into the open position, with the result that the oil ran out of the well, lubrication ceased, and the bearing seized.

The second instance recorded was that of a two-pole, overhung, direct-current, enclosed motor of five horsepower, running at 960 revolutions a minute and taking current at 460 volts, for driving brewery machinery by a belt. The armature shaft was carried by bearings lined with white metal and located in the end plates. Examination of the breakdown by the company's inspector showed that the oil well of the damaged bearing was so full of dirt that the lubricating ring could not revolve, and consequently the journal had ceased to receive oil and had become overheated, so that the white metal was melted out. The oil well of the other bearing was almost in the same condition, and both had evidently been neglected for a long time. In consequence, the armature had been rubbed against the pole faces, which had stripped off one of the wire binders and cut up the installation of the conductors; the fuse melted, and the motor came to a standstill.

An instance was given of the wearing of journals through neglected lubrication. The machine in question was a two-pole, overhung, compound-wound, direct-current dynamo generating 110 amperes at 230 volts when running at 940 revolutions a minute. The cause of the trouble was excessive wear of the gun-metal bearings which carried the armature shaft. Four of the armature conductors were fused under the binder next to the commutator, and three other binders were almost worn through by rubbing on the pole-faces. The wear of the bearings was attributed to neglect of lubrication.

The dangers of oil creeping were shown by the case of a two-pole, compound-wound, open-type, belt-driven, direct-current dynamo generating 200 amperes at 100 volts at 700 revolutions a minute. The commutator was earthed, the mica insulation between three of the bars was burned, the conical clamping ring at the back of the commutator was fused, and the solder which cemented the armature conductors to two of the commutator lugs was melted. The cause was attributed to short-circuits between four of the commutator bars and the clamping ring at the end next to the armature. The short-circuits were established by accumulations of carbon dust and oil behind the commutator lugs. In this case a blast of air from a compressor to keep this very vulnerable part of the commutator clean was rendered ineffective by the oil.

The result of neglect and damp was instanced in the case of a three-phase, alternating-current motor, giving ten horsepower at 750 revolutions, with current at 190 volts per phase. The motor was placed in a pit below the floor of a boiler shop, and drove plate-bending rolls through gearing. The breakdown of this motor was finally caused by the failure of the installation between the stator windings and the frame. The cause of the trouble was that the slots in the bottom coil were full of dust and oil and the installation was saturated. The stator had to be entirely reinsulated. Another very similar case was that of a motor driving hauling machinery in a mine.

[*To be continued.*]

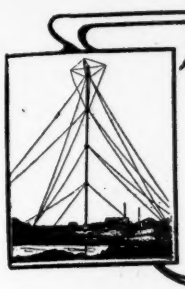
Cost of Electric Haulage.

The Chiltern Valley Gold Mining Company, Victoria, Australia, says *The Electrician,* of London, Eng., recently issued a comparative statement showing cost per ton for conveyance of wash dirt to the shaft from a distance of 4,000 feet, as follows: Electric haulage, 1.14 cents; horse haulage, 4.10 cents; manual haulage, 11.96 cents. Taking into account the lighting of the surface works by electricity, electric haulage would work out to but one cent a ton for the 4,000 feet. Allowing ten per cent for plant depreciation, this cost would be increased by 0.18 of a cent per ton.

The Electrolysis Problem in Winnipeg.

Prof. Louis Herdt, of McGill University, Montreal, Can., who has made considerable researches of late on the electrolysis problem, has had his recommendations in a recent report prepared by him for the city of Winnipeg put into effect. One of three sub-power stations has recently been opened, and the others will shortly be completed. By this means, and by carefully bonding the car rails, it is expected that electrolysis will be reduced to a minimum.

At a special meeting of Armour Institute of Technology Branch of the American Institute of Electrical Engineers, held in Chapin Hall on the evening of October 28, C. C. Bailey read a paper on "Railway Block Signaling."



TELEGRAPHY—TELEPHONY, and WIRELESS.

Train Despatching by Telephone.

A recent despatch from Austin, Texas, says it is officially announced that the telephone system for despatching trains is to be installed on the lines of the Southern Pacific Company in Texas and Louisiana, and that the work of making the change will be started in a very short time. In all, more than 2,000 miles of the Southern Pacific system are to be so equipped within the next twelve months. The original order for the matter of making the change to be taken up is said to have come from the late E. H. Harriman about a year ago.

Yet another road to use the telephone for train despatching is the Norfolk & Western Railroad, which has recently put into service two telephone circuits for handling its trains, one between Roanoke, Va., and Bluefield, W. Va., 102 miles, the other between Bluefield and Williamson, W. Va., 107 miles. There are six stations on the former circuit and twenty-two stations on the latter. This equipment extends through some very mountainous country and affords a good test of telephone train despatching under very severe conditions. A feature of interest in connection with one of these circuits is that the telephone was pressed into service before being fairly completed owing to the telegraph circuits having gone out of commission.

The Santa Fe system will also use the telephone in place of the telegraph for train despatching, the first section selected for this change being the 887 miles of the Albuquerque and Arizona divisions.

The Seaboard Air Line now has in operation its new telephone train-despatching circuit between Raleigh and Monroe, N. C., 148 miles. This part of the road is single track, and handles a heavy traffic, the movement of trains being assisted by a block telephone system. The despatcher is located at Hamlet, N. C., ninety-five miles from Raleigh.

Western Electric telephones and Gill main-line bridged selectors are used throughout this equipment. There are twenty-nine selector way stations and two siding telephones located in the weather-proof booths at blind sidings. Two portable telephones are provided for wreck cars. These may be connected to the despatcher's line at any point by means of a jointed line pole.

W. F. Williams, superintendent of telegraph, who has charge of the work, states that the telephone circuit has worked perfectly ever since being put into service. He says that the transmission could not be better, and that he has heard a watch tick over the entire 148 miles of the line. The despatchers find that they can handle the business faster, more comprehensively and with less fatigue.

That the running of trains by telephone has proven satisfactory on the Sunbury division of the Pennsylvania Railway is evidenced by the fact that a force of men is now at work above Nescopeck, Pa., preparing to extend the telephone system to Wilkes-Barre and install instruments in the stations and towers between the two points. The telephones have been in use between Nescopeck and Sunbury for several months and are used to a greater extent, though not exclusively, in the running of trains.

The above are only a few of many similar changes from telegraph to telephone for use in train despatching, but these may be taken as indicative of the trend of railroad practice in this line of work.

Japanese Study Wireless.

W. Torokati, of the Investigating Bureau of Electricity in the Japanese government, is in this country studying the machinery of the United States. He will devote much time to wireless appliances, as well as electrical machinery, which may be used for manufacturing purposes. Mr. Torokati is a graduate of Tokio University, and has become the head of wireless telegraphy in his country, outside of navy circles. There are, he says, five land commercial stations in Japan, each of about five-kilowatt power, and all under the jurisdiction of the Department of Communications.

High-Speed Wireless Telegraphy.

A new high-speed automatic transmitter for wireless telegraphy was demonstrated on September 11 and 13 last, at the Cullercoats Wireless Station, near the mouth of the River Tyne, on the north-east coast of England, before officials of various British government departments and others. We are indebted to *The Electrical Times,* of London, England, for the following description:

"The Cullercoats station is fitted for working with both the de Forest spark method and the Poulsen arc method of radiotelegraphy, but it is for the latter that the high-speed transmitter is adapted. On September 11 it was shown that with the employment of the automatic transmitter a speed of sending can be obtained rivaling that realized with submarine cables. Doctor Poulsen is responsible for the design of the transmitter, but at present there is only one example of it in existence, at Lyngby in Denmark. Lyngby is about 600 miles from Cullercoats, and since it is near Copenhagen the electric waves must necessarily traverse the land for a part of the distance. The machine is worked on much the same principle as the Wheatstone automatic transmitter used in ordinary land telegraphy; that is to say, the message to be sent is represented by a series of holes punched in a continuous paper strip, those on one side of the central line being the dots of the Morse code and those on the other the dashes.

"This paper strip is fed into the transmitting apparatus, which consists essentially of a rotating contact-making device, and the holes in the paper actuate mechanism by which the continuous waves produced by the arc generator are cut up into lengths, short for the dots and longer for the dashes. Any oscillations thus emitted are received by the antenna at the receiving station and conducted to a detector, which in this case consists of a piece of tellurium pressed lightly against a surface of galena.

"A string galvanometer is employed, in which a fine metal wire, normally

stretched in a vertical position, is deflected sideways by the action of the current received from the auxiliary circuit. This string or wire is mounted in the beam of a Nernst lamp, with a suitable optical condenser, which throws the light on a narrow slit, behind which a band of photographically sensitized paper is moved by an electric motor. The shadow of a small portion of the wire as it vibrates to and fro in response to the signals from the sending station is thus imprinted on this band, which is immediately drawn automatically, first through a developing bath, and then through a fixing bath, so that as fast as the message arrives it can be read on the paper band in the form of a wavy or zigzag line, like that yielded by the siphon recorder in submarine telegraphy.

"There was no opportunity on September 11 of seeing the transmitter itself, since, as has already been said, the only example of it yet made is in Denmark, but several experiments were carried out in receiving messages sent by it. A standard telegraphic word of five letters, 'Paris,' was sent repeatedly at the speed of fifty times a minute, the resulting record being perfectly sharp and clear. Next some other words, which had already been punched at Lyngby, were transmitted at the same speed with equal success. Then a message selected at random was transmitted with the ordinary hand key to Lyngby by wireless, and after being punched there was returned by the automatic transmitter at the same speed of fifty words a minute. Finally, as a severer test of the capabilities of the apparatus, this same message was transmitted several times over at a speed which well exceeded 100 words a minute. The power employed at Lyngby was understood to be ten electrical horsepower, and the wave length was 1,800 metres. Doctor Poulsen and his associates anticipate that they will succeed in telegraphing across the Atlantic at a speed of at least fifty words a minute with the expenditure of 100 horsepower; in this connection it will be remembered that, as Mr. Marconi stated on June 25, in his speech at the Imperial Press Conference, the present speed of wireless working across the Atlantic is twenty-five words."

Experiments with the portable wireless outfits for the German army have shown that with them communication can be maintained between Berlin and Vienna, a distance of 963 miles.

Telephones in Canada.

Independent telephones are on the increase in the Dominion of Canada. The declared policy of the independent companies is to have no arrangements with the Bell company for interchange of service over that company's lines. At the recent convention of the Canadian Independent Telephone Association, held at Toronto, it was shown that there were now over 27,000 Independent telephones in operation in Canada. In the provinces of Manitoba and Alberta, where the Bell equipment had been purchased by the provincial governments over a year ago, the mileage and number of telephones in use have increased very rapidly under government operation and control.

It was pointed out by an American visitor that, in 1895, there were only 245,000 telephones in the United States, but as a result of competition, there are now more than 6,000,000 telephones in operation in that country. The Independent companies there have installed new plants and have forced the other companies to improve theirs. Canada was considered as fortunate in having a spirit of public ownership which, it is claimed, is frowned upon by municipal officers and governments in the United States.

As the work of the Independent companies is becoming more and more of a national character in Canada, it has been decided to urge the provincial legislatures throughout the Dominion to at once introduce legislation that will bring about the provincial ownership and operation of all long-distance lines.

Measurement of Distance by Electric and Sound Waves.

The following article, attributed to *Prometheus,* appears in a recent issue of the *Scientific American:*

Debrix has invented a method of measuring a ship's distance from a shore station, by taking advantage of the difference between the velocities of sound and electric waves. A bell is set ringing and wireless electric waves are generated simultaneously on the ship. The electric waves arrive almost instantaneously at the shore station and there set in motion a stop-clock. The distance of the ship can be computed from the number of seconds indicated on the dial when the sound of the bell is first heard. The computation is facilitated by the use of a table, in which, if necessary, allowance may be made for the fraction of a second consumed in the operation of the receiving and clock-starting apparatus. In this way the distance of the ship can be obtained, but not its direction or exact position. If, however, the ship's auditory and electric signals are simultaneously received at two stations connected by telegraph, the exact position of the ship on the chart will be found at the intersection of two circles, drawn round the stations as centers, with radii respectively equal to the ship's ascertained distances from those stations. The general introduction of this system would greatly increase the possibility of aiding ships in distress.

Ocean Cables and Commercial Telegraphs.

Treating of the commercial telegraphs and ocean cable systems, it may be pointed out that in 1880 there were seventy-seven companies; in 1902, twenty-five, and in 1907, twenty-five, and it explains that the noticeable decrease since 1880 in the number of separate companies is due to numerous consolidations of formerly competing companies. The decrease since 1880 has been accompanied by a very large increase in business and equipment. It is shown that, with the exception of one unimportant unincorporated company, the entire commercial telegraph and cable industry is operated under the incorporated form of ownership, with capital stock and bonds of an authorized par value of $173,126,075 in 1902 and in 1907, $244,607,900. The outstanding par value in 1902 was $162,946,525 and in 1907, $220,293,575. The companies expended for salaries and wages $17,808,249 and for other purposes $24,071,364 in 1907. Their income was reported for 1907 only eleven paid dividends, although the total receipts of the telegraph companies exceeded those for 1902 by $10,653,830. There were but five companies not operated at a profit, and their combined loss was only $18,652. The report shows the extent to which this industry is controlled by a few companies, there being six reporting 97.7 per cent of the total income and 97.5 per cent of the operating expense. In 1902 the six largest companies reported ninety-nine per cent of the total income and expense.

Underwriters Favor Wireless for Ships.

From London comes the statement that the last year has been so disastrous to underwriters that a greatly enhanced impetus has been given to the study of new safety appliances and to the development of those now in use. The underwriters

of Cape Town, who have been badly hit by the loss of various ships sailing under the Southern Cross, have unanimously recommended the installation of wireless telegraphy on all passenger ships.

"Such a step would be welcomed by all underwriters," stated a high shipping authority, "and it would be warmly welcomed by those in Liverpool. It would tell against underwriters as a class, for the installation of wireless telegraphy on a ship would materially reduce the amount of the premium; but on the ground of humanity we are greatly in favor of every ship having its wireless apparatus. There is no necessity for us to have a special meeting on this matter, for all Liverpool underwriters are in accord with one another on the subject. It is no use leaving it a voluntary business. To be of any use it must be compulsory and universal. Nevertheless, we cannot make a recommendation on the subject, because we recognize the tremendous cost of placing a wireless apparatus on each ship. It might not be so difficult for the great lines, but it would be almost impossible for the owners of tramp steamers. Until the cost of wireless installations is materially reduced we must not expect to see it in universal use."

Electrophoning Lord Rosebery's Speech.

Further accounts have come to hand of the electrophoning of Lord Rosebery's speech from Glasgow to London, as reported in a recent issue. It appears that Lord Rosebery spoke from 2 to 4 o'clock, and that nearly six columns of the speech were printed in the papers, which were on sale in the London streets, *before Lord Rosebery had finished speaking in Glasgow*. This most wonderful performance is said to be absolutely unprecedented. The electrophone transmitters were of a type invented by Giuseppe Angelini, an Italian.

Standard Time by Telephone.

Arrangements have been completed, says *Nature* (London, Eng.), whereby a standard clock at the Hamburg Observatory Bergedorf is connected to the trunk telephone system. A sounder automatically emits a siren-like note from the fifty-fifth to the sixtieth second of each minute—mid-European time—and this goes automatically to all the receivers connected, at that time, with the special exchange number which has been allotted to the time signal. Thus Hamburg and district are given standard time.

President Vail on Telephone Progress.

In an interview President Theodore N. Vail, of the American Telephone and Telegraph Company, is quoted as saying:

"Great as has been the progress of the telephone, its future promises much that even now is being foreshadowed. There is no doubt that as a servant to mankind telephony has been instrumental in producing results in industry, commerce and social life that could not possibly have been brought about without it.

"As for the American Telephone and Telegraph Company, the business has progressed at a rate that measures up more than satisfactorily with the expenditures made for equipment and general improvements. The recent policy of consolidation, unifying various interests in New York and New Jersey, should be productive of much good. Unification is the success of all large enterprises. In no other line of activity is this more essentially established than where the telephone is concerned.

"The great Northwest is another example of what can be done through the general use of the telephone. It is beyond a doubt that farming has been simplified through the means of transportation, and this applies equally to oral communication. But the systems today must be equipped with the best possible apparatus. This desire to improve the service has also been put into practice on the Pacific Coast, where the Pacific Telephone and Telegraph Company proves it pays to be well equipped."

Navy Wireless Tests.

A despatch from Washington states that important experiments in long-distance wireless are to be undertaken by the United States Navy on the Atlantic seaboard some time in December next. A tower 400 feet high, owned by a private company, has been erected at Brant Rock, Mass., and the necessary instruments are already installed, with a view to communicating a distance of 3,000 miles. Two United States scout cruisers, the Salem and the Birmingham, will be despatched in the early part of December on a trip which will keep them within the 3,000-mile radius of the transmitting station, and these vessels will be utilized as receiving stations for the wireless experiments. The proposed cruises will probably be in a region comprised between the coast of Scotland and the West African coast, and also in the American tropics. The vessels, which have been each equipped with a ten-kilowatt apparatus, will also experiment in long-distance work, up to a radius of 1,000 miles, between ships at sea. It is possible that one outcome of these tests will be the installation of a wireless tower at Washington.

Wireless Operation in Alaska.

More evidence of the successful working of the military wireless telepraph stations in Alaska is shown in a report from First Lieutenant F. A. Jeunett, Thirteenth Infantry, at Port Gibbon. On the night of September 23 the station at Nome worked well both ways with the steamer Minnesota, en route to Japan, about 200 miles south of Mimak Pass and about 1,300 miles from the wireless station. The Minnesota also reported hearing messages from Fort Gibbon, strong and loud. More than 500 miles of the distance traveled by the messages from Fort Gibbon was overland and the station at that place also picked up messages from the steamer at Mimak.

The Telephone Business.

In the amount of business done, the sum paid in salaries and wages and the capital invested in 1907, the telephone business was a little over three-and-one-half times as extensive as the telegraph industry, and during that year it furnished employment for more than five times as many persons.

Between 1902 and 1907 there was an addition of 8,098,918 miles of wire for the use of the telephone systems, as compared with an increase of but 259,611 in the mileage of owned and leased wire for commercial telegraph purposes. The increase in the wire mileage of the telephone systems during the five years referred to was more than six times as great as the total amount of wire added to the telegraph business since 1880.

Opportunity for Wireless Manufacturer.

An American consul reports that a company has been organized in England for the installation of a wireless-telegraph system in the South Pacific. The company will await the result of some experiments which are in progress before beginning the installation of the system, and the consul states there may yet be time for American manufacturers to make bids. The name of the person to whom communications should be addressed is given in the report. Inquiries, quoting File No. 4053, should be referred to the Bureau of Manufactures, Washington, D. C.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MONTREAL STREET RAILWAY.

The annual report of the Montreal Street Railway Company for the fiscal year ended September 30 shows an increase in gross earnings of $197,406, in total income of $84,376, and in surplus after charges of $17,657. Following is the income account, with changes:

	1909.	Increase.
Gross earnings	$3,874,838	$ 197,406
Operating expenses	2,255,019	96,625
Net earnings	$1,619,819	$ 100,781
Interest from M. P. & I. Ry.	55,606	*16,405
Total income	$1,675,425	$ 84,376
Total deductions	445,749	*8,889
Balance for dividends	$1,229,676	$ 93,265
Dividends (10 per cent)	976,332	75,608
Surplus	$ 253,344	$ 17,657
Appropriations—		
Contingent account	$ 175,000	.....
Fire insurance account	25,000	.....
Total appropriations	$ 200,000	.....
Final surplus	$ 53,344	$ 17,657

*Decrease.

President L. J. Forget says that current gross earnings of the company continue to show satisfactory increases. The premium on the last issue of new stock, amounting to $142,685, was paid up during the year and has been credited to surplus. During the year the company expended for construction, equipment, real estate, etc., a total of $189,449.

The Montreal Terminal Railway Company showed gross earnings for the year $11,261 higher than in the previous year, operating expenses $308 more and the net surplus for the year was $5,477, as compared with a deficit of $5,162 in the year previous.

PHILADELPHIA COMPANY.

The report of the Philadelphia Company and affiliated corporations shows earnings from all operations, for the nine months ended September 30, 1909. The account compares as follows, January 1 to September 30:

	1909.	1908.
Gross	$13,210,150	$12,261,314
Expenses and taxes	7,527,754	7,453,833
Net	$ 5,682,396	$ 4,807,481
Other income	222,099	193,834
Total income	$ 5,904,495	$ 5,001,315
Charges, rent, etc	3,437,624	3,351,513
Balance	$ 2,466,871	$ 1,649,802
Preferred dividend	225,000	225,000
Surplus	$ 2,241,871	$ 1,424,802
*Proportion	2,834	1,236
Available for Philadelphia Company	$ 2,239,037	$ 1,423,566

*Proportion due to other owners of common stock of affiliated corporations.

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 533,329	$ 508,130
Expenses, taxes, etc	342,981	332,485
September net	$ 190,348	$ 175,645
Nine months gross	4,757,630	4,554,713
Expenses, taxes, etc	3,101,425	2,983,883
Nine months net	$1,656,205	$1,570,830

NORFOLK & PORTSMOUTH.

The report of the Norfolk & Portsmouth Traction Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 158,234	$ 162,938
Expenses	88,373	94,834
September net	$ 69,861	$ 68,104
Nine months gross	1,436,199	1,395,233
Expenses	833,363	835,270
Nine months net	$ 602,836	$ 559,963

BOSTON ELEVATED RAILWAY COMPANY.

The annual report of the Boston Elevated Railway Company for the year ended September 30, 1909, compares as follows:

	1909	1908.
Gross	$14,493,853	$14,074,696
Expenses	9,488,484	9,454,386
Net	$ 5,005,369	$ 4,620,310
Other income	.....	.....
Total income	$ 5,005,369	$ 4,620,310
Charges	4,163,951	†3,780,246
Surplus	†$ 841,417	$ 840,064
Dividends	802,503	798,000
Surplus	$ 38,941	$ 42,064

*Includes charges to depreciation fund.
†Equal to 4.22 per cent on $19,950,000 outstanding capital stock as against 6.31 per cent on $13,300,000 stock last year.

EDISON ELECTRIC ILLUMINATING COMPANY, OF BROOKLYN.

The New York Public Service Commission has issued a report covering the operations of the Edison Electric Illuminating Company, of Brooklyn, for the year ended December 31, 1908, as follows:

Operating revenue	$ 3,549,784
Operating expenses, taxes, etc	2,152,615
Operating income	$ 1,397,169
Non-operating income	14,858
Total income	$ 1,412,027
Interest, rentals, etc	1,401,028
Net corporate income	$ 10,999
Net profit and loss debit	10,999

The principal operating statistics are compared as follows:

	Dec. 31,'08.	Dec. 31,'07.
Number of consumers	13,224	11,438
Number of meters	20,547	18,088
Number of meters in company's service	45	41
Number of incandescent lamps	985,062	72,174
Number of Nernst lamps	2,242	1,724
Number of arc lamps	11,861	1,654

CHICAGO CONSOLIDATED TRACTION.

The receivers of the Chicago Consolidated Traction Company report for the month of August, 1909, as follows:

Gross earnings	$251,087
Operating expenses and taxes	205,892
Net earnings	$ 45,195
Bond interest	40,526
Surplus	$ 4,669

Surplus as indicated above is in excess of interest on underlying bonds and $20,643 short of required monthly interest on $6,750,000 of four-and-one-half per cent general mortgage bonds.

Steps toward the reorganization of the company are proceeding steadily, with every prospect of complete success.

NEW YORK TRACTION LINES.

The New York Public Service Commission for the First District has issued the following statistics in connection with passengers carried and revenues derived from operation on traction lines of New York during the month of July, 1909, as follows:

	Fare Passengers, July, 1909.	Total Rev. from St. Ry. Oper
Interboro Rapid Transit	39,091,968	$2,015,025
B. R. T. System:		
Brooklyn Un. Elev	14,482,405	$ 757,240
Sea Beach	417,610	21,698
South Brooklyn	1,331,663	70,995
Total elev. train service	16,231,878	$ 849,935
Brooklyn Heights	12,565,828	638,444
Brooklyn, Q. Co. & Sub	2,197,172	114,266
Coney Island & Graves	245,807	12,548
Nassau Electric	7,838,870	402,926
Total B. R. T. System	39,079,555	$2,018,121
*Third Avenue System:		
Dry Dock, East Broadway	964,881	$ 55,760
42d St. M. & St. Nic	2,372,064	120,946
Third Avenue, Kingsboro	4,615,313	281,632
Southern Boulevard	195,546	9,777
Union Railway Co	3,906,206	198,934
Westchester Electric	1,051,665	53,291
Total	13,105,675	$ 720,342
Manhattan and Bronx surface roads:		
Metropolitan St. Ry	20,771,983	$1,062,673
Central Park, N. & E. R	1,032,038	54,155
Second Avenue	1,562,362	81,728
28th & 29th Sts. Cr	37,085	1,879
Total Manhattan	23,403,468	$1,200,440
City Island	23,046	1,101
Pelham Park	28,681	1,562
New York City Interboro	353,413	16,596
Total Man. and Bronx	23,808,608	$1,219,700
Brooklyn and Queens surface roads:		
Bush Terminal	.....	$ 3,549
Coney Island & Brooklyn	3,690,552	178,551
Long Island Electric	461,576	25,530
Marine	46,846	2,342
N. Y. & L. Island Traction	770,617	38,804
N. Y. & Queens Co	2,000,360	102,224
Ocean Electric	525,463	26,367
Van Brunt St. & E. B	141,462	4,022
Total, excluding B. R. T.	7,636,876	$ 381,391
Richmond electric roads:		
Richmond Lt. & R. R	834,489	$ 42,658
South Beach	52,402	2,720
Staten Island Midland	726,351	37,082
Total	1,613,242	$ 82,460
Gr'd total, all companies	124,335,924	$6,437,042

*Exclusive of the Tarrytown, White Plains & Mamaroneck and the Yonkers Railroad.

SAN FRANCISCO UNITED RAILROADS.

The report of the United Railroads of San Francisco for the month of August shows a gross income of $642,120, as compared with $587,733 for August, 1908, an increase of $54,387. The expenses for the month were $363,952, as compared with $356,028 for last year, showing an increase of $7,925. The net earnings for August were $278,168, as compared with $231,705 for the same month last year, showing an increase of $46,463. A.

Annual Meeting and Report, Commonwealth Edison Company.

The annual meeting of the stockholders of the Commonwealth Edison Company, of Chicago, was held on November 8. The directors submitted their annual report for the fiscal year ended September 30, 1909, from which the following facts are taken:

During the past year the directors have issued and sold $11,250,000 of the company's bonds and have paid off the following obligations:

$ 500,000 Commonwealth Electric Company 5% debentures.
588,000 Chicago Edison Company 5% first-mortgage gold bonds.
183,000 Chicago Edison Company 6% debenture bonds.
,000,000 Chicago Edison Company 5% three-year gold debentures.
269,000 Chicago Sectional Electric Underground Company first-mortgage bonds.
90,000 Real estate mortgages.

The directors recommended to the stockholders an increase in the company's authorized capital stock of $10,000,000, to be issued from time to time, as the directors may deem advisable.

The earnings and expenses for the fiscal year have been as follows:

Gross earnings (including merchandise sales)		$10,639,446.50
Expenses (including depreciation and cost of merchandise sales)		6,642,693.67
Earnings for the year		$ 3,996,752.83
Charges against earnings:		
Interest on bonds and debentures	$1,182,506.63	
Depreciation reserve	427,250.00	1,609,756.63
(Under the terms of the mortgages made by the Chicago Edison Company and the Commonwealth Electric Company.)		
Available for dividends		$ 2,386,996.20
Dividends paid		1,800,000.00
Balance carried to surplus		$ 586,996.20
Balance surplus, September 30, 1908		1,442,820.50
Surplus September 30, 1909		$ 2,029,816.70

The condensed balance sheet for the year is as follows:

ASSETS.		
Plants, real estate, etc.		$57,105,744.41
Unfinished plant investment		99,377.92
Open accounts		180,183.71
CURRENT ASSETS.		
Material in storerooms	$ 793,777.05	
Coal in storage	92,107.50	
Accounts and bills receivable	1,287,464.02	
Cash	1,026,329.76	
		3,199,678.33
		$60,584,984.37
LIABILITIES.		
Capital stock		$30,000,000.00
Five per cent first-mortgage gold bonds of the Commonwealth Edison Company		11,250,000.00
Five per cent first-mortgage gold bonds of the Commonwealth Electric Company		8,000,000.00
Five per cent first-mortgage gold bonds of the Chicago Edison Company		5,412,000.00
Real estate mortgage		130,000.00
Depreciation reserve		2,221,750.00
(Under the terms of the mortgages made by the Chicago Edison Company and the Commonwealth Electric Company.)		
CURRENT LIABILITIES.		
Accounts payable	$783,519.47	
Municipal compensation	122,468.19	
Bond interest, accrued, matured and unpaid	224,042.46	
Taxes accrued	411,387.55	
		1,541,417.67
Balance surplus, September 30, 1909		2,029,816.70
		$60,584,984.37

The company's connected business (exclusive of electrical energy supplied to other public service corporations) amounted to the equivalent of 4,920,800 standard sixteen-candlepower lamps on September 30, 1909.

At the regular annual meeting of the stockholders of the company held Monday, November 8, all of the members of the board of directors were re-elected and the capital stock was increased from thirty million to forty million dollars. The board of directors subsequently re-elected all of the officers.

Hudson Companies' Earnings in Excess of Fixed Charges.

With the present passenger traffic running at the rate of 40,900,000 a year, the Hudson & Manhattan Railroad Company is not only enabled to pay bond charges, but is earning approximately one per cent on its $10,000,000 five per cent non-cumulative preferred stock.

The gross revenue of 40,900,000 passengers at a five-cent fare is	$2,045,000
From previous estimates the operating cost, including taxes, will not exceed 40 per cent, or	818,000
Net passenger earnings	$1,227,000

The earning capacity of the terminal buildings at Church Street is $1,200,000, and $300,000 is the figure placed for the net income for advertising, news-stands and other privileges. These together with the present passenger earnings total $2,727,000; from this is to be deducted interest on bonds issued, $2,567,000.

The surplus is thus $160,000, which is equivalent to 1.6 per cent on the authorized preferred stock.

Passenger traffic has more than trebled since the first part of the system was opened. An idea of this increase, and the daily average for the different periods, may be seen from the following table:

	Days.	Passengers Per Period.	Average.
Feb. 26 to June 30, 1908	126	4,480,320	35,304
July 1 to Sept. 30, 1908	92	2,427,461	26,385
Oct. 1 to Dec. 31, 1908	92	3,794,585	41,245
Jan. 1 to March 31, 1909	90	4,049,319	44,992
June 1 to July 15, 1909	45	2,104,740	46,772
July 16 to Aug. 1, 1909	16	1,360,000	85,000
Aug. 2 to Aug. 30, 1909	29	2,755,000	95,000
Aug. 31 to Sept. 24, 1909	25	2,875,000	115,000
Sept. 25 to Oct. 2, 1909	8	1,128,000	141,000
Oct. 3 to Oct. 10, 1909	8	920,000	115,000
Totals	531	25,894,425	

From the above figures it is seen that the opening of the downtown section, on July 15 last, practically doubled traffic, and since that time it has increased the average from 46,772 to 115,000 passengers daily. The daily average of 141,000 for the week of September 25 was due, of course, to the Hudson-Fulton celebration. During the four parade days the company carried 604,000 passengers, an average of 151,000 daily, and 524,000 were transported during the remainder of the event. But the daily average has now settled down to 115,000 again. The decrease that is so evident during the month of July, August and September can probably be ascribed to the hot weather that prevailed during that period when the ferries offered attractions in the way of fresh air and cool breezes, though the traffic is naturally lighter during the summer months.

It is expected that the line, exclusive of the Forty-second Street extension, will be completed and in full operation by next summer.

On the New York side things are running without a hitch. Of the fifty per cent of the property owners' consents necessary for the extension to Grand Central Station forty have been received; the other ten are held up owing to the absence of the parties concerned. During the present month it is expected that the balance will be obtained, and the line will doubtless be in operation by 1912.

Salem Electric Company Sold.

Charles H. Tenney, of Boston, has purchased control of the Salem (Mass.) Electric Company at a price understood to be about $300 a share. Practically all of the 2,750 shares of the company were pooled last May at a minimum selling price of $225 per share, since which time several different interests have been in negotiations for control. The company has paid $18 per share in dividends for the present year.

Mr. Tenney and associates now control the following gas and electric companies: Concord (N. H.) Electric Company, Haverhill Electric Company, Malden Electric Company, Malden & Melrose Gas Light Company, Springfield Gas Light Company, Salem Electric Company, Suburban Gas and Electric Company, Fitchburg Gas and Electric Company, all of Massachusetts, and the People's Gas and Electric, Oswego, N. Y.

Rubber Companies Consolidate.

The Intercontinental Rubber Company, with a capital of $40,000,000, and the Continental Rubber Company, with a capital of $30,000,000, have recently merged in order to facilitate business management. The Intercontinental Rubber Company already owned a large part of the stock of the Continental Rubber Company.

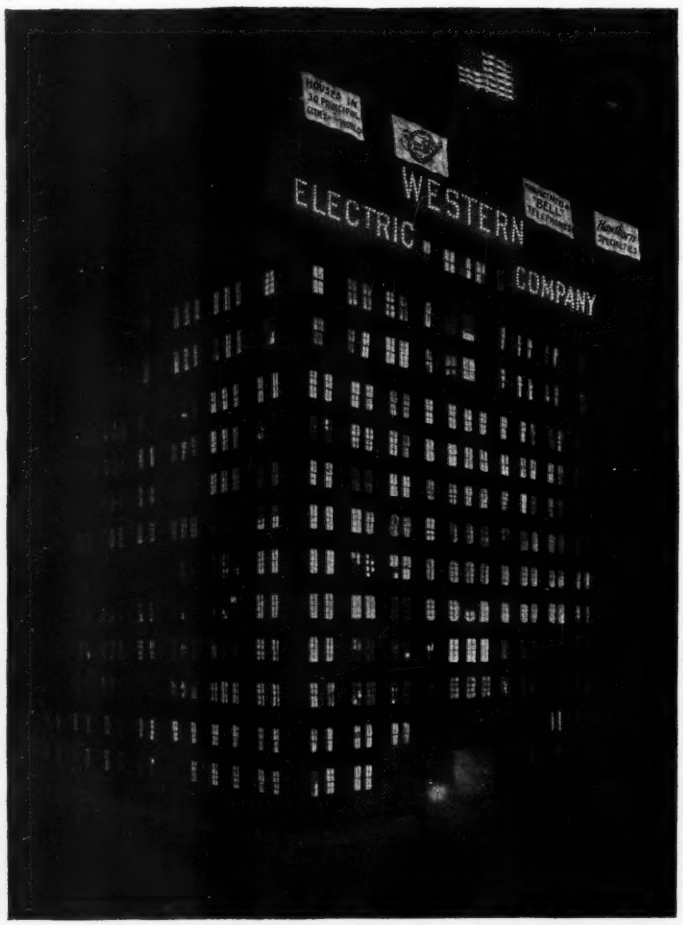
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Western Electric Arc-Lamp Displays at the Hudson-Fulton Celebration.

During the Hudson-Fulton celebration, particulars of which have already been given in these columns, business and commercial houses in and around New York city vied with each other to obtain the best illumination effects.

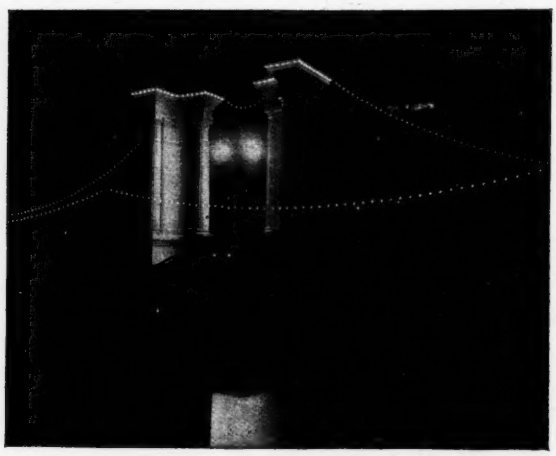
A noteworthy instance of the few arc-lamp installations was seen at the thirteen-story building of the Western Electric Company, which faces on West Street, directly overlooking the river from its front, north and south windows.



ILLUMINATION OF THE WESTERN ELECTRIC BUILDING.

The arc lamps used in the rooms and offices of the building were the Hawthorn enclosed carbon type, which are so extensively used at the present time for factory illumination. The distribution of the lamps was not specially arranged for a lighting display, but was that used for lighting the interior of the building under working conditions. The shades of approximately 200 windows facing directly west were simply lifted, with the effect as shown in the illustration. Unlike most of the buildings which had their outlines illuminated with festoons of incandescent bulbs, the effect at a distance was of an interior of considerable depth. On the roof of this building five immense flags floated from staffs, each under the rays of its own spot light.

Another feature of arc-lamp lighting is shown herewith in the other illustration, which is a photograph of the "Water Gate" which was erected at the foot of 110th Street. The intensity of the artificial light at this arch, which was produced by two Hawthorn flaming arcs, is readily seen from the distinct showing up of the design in the ornamentation on the column caps.



ARC ILLUMINATION AT "WATER GATE."

The flaming arcs were suspended as shown from the top of the arch and between the two great white supporting columns at the Water Gate, which are thrown into relief by the rays. Due to the lamps being suspended at a considerable height and to the soft yellow color of the rays, there was no blinding effect when standing at close range. The lamps, therefore, served a double purpose of decorative illumination and providing an intensity of light which was sufficient to light up the arch nearly as well as in daylight.

Inauguration of the Triumph Companies' New Plant.

On Saturday, October 23, an informal reception was given to the employes of the Triumph Electric Company and of the Triumph Ice Machine Company, to celebrate the opening of the new joint plant at Oakley, near Cincinnati, Ohio. Notwithstanding a steady downpour of rain, there was a large and enthusiastic gathering of employes with their families and friends.

An inspection of the plant, which is of the most modern construction, was made by the entire party. An excellent band, located on the third gallery, furnished music, while the younger members of the party danced. Ices and other refreshments were served.

During the intermission several excellent speeches were made. The deputy mayor of Oakley welcomed the Triumph Company to the community. He said that Oakley was proud to harbor such a

progressive and up-to-date concern and felt sure that the community at large would benefit thereby. It was a matter of gratification that Oakley would now be known all over the American continent; in fact, wherever modern machinery was in use.

A delegate of the Triumph employes spoke feelingly of the good fellowship and good will that existed between the management and staff, and expressed a wish that such a feeling would long continue.

J. C. Hobart, the manager, in reply referred to the value of "team work." He said that it was team work that had built up the Triumph company and had made the present buildings possible. It was team work that would eventually enlarge the plant to double or treble the present proportions, and he felt sure that if all the employes continued to "pull together," as they had done in the past, it would be a matter of only a few years before the extensions planned would be erected.

An energetic call for the president of the company, brought W. H. Hobart quickly to his feet. He said that it afforded him considerable pleasure to see the employes, their wives and children, all gathered together, and he welcomed the opportunity to say a few words to them collectively. He pointed out in a very convincing manner that the interests of the company and of the employes were identical. The advancement of the company meant better conditions and advancement for the men and reflected naturally to their wives and families. He fully believed that each and every man had the interest of the company at heart and cited as a proof of this the remarkable celerity with which the old factory had been dismantled and the new plant fitted up. He had hardly believed that such a feat was possible, and it spoke volumes for the zest and energy of the men that it had been accomplished in such a short time.

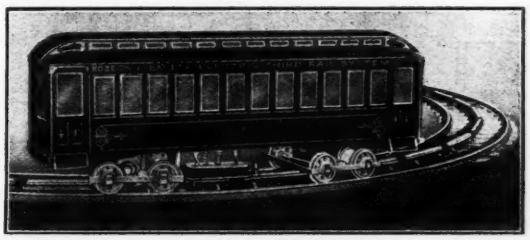
As described on pages 604 and 605 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 25 last, the new factory is 300 feet long, three stories high and 140 feet wide, and provides some 125,000 square feet of floor space. The building represents a capital outlay of approximately $250,000, in addition to which over $50,000 worth of new equipment has been purchased. The increased facilities will enable both the Triumph Electric Company and the Triumph Ice Machine Company to turn out even better work than heretofore.

Kozesnik Safety Third-Rail System.

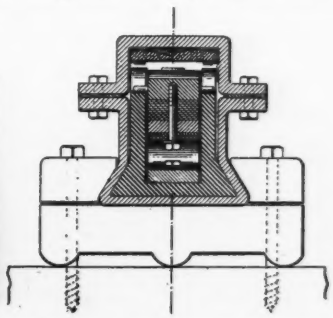
Numerous types of sectionalized third-rail systems and also the so-called surface-contact systems have been in evidence, the latter being used somewhat in Great Britain.

The Kozesnik Safety Electric Third-Rail Company, of New York, N. Y., however, has patented a harmless high-voltage, third-rail system for which is claimed the solution of what is still regarded by many as the dangerous third-rail problem.

The third rail in this system is mounted between the two main rails and comprises box and contact members made in sections. The contact members are constructed of a non-magnetic metal; the box members are made of a suitable material, and the third-rail sections are separated by block insulators. Each rail section is supported upon sleepers of insulated material which rest upon ties or other foundations in the roadbed, the same as the live third rail.

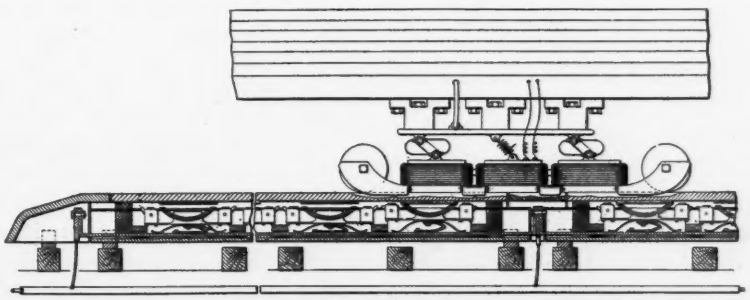


DEMONSTRATION OF KOZESNIK THIRD-RAIL SYSTEM.



CROSS-SECTION THROUGH THIRD RAIL.

Within the rail sections are a series of vertically movable armatures and contact members which are actuated by the movements of the armatures. Means are provided for electrically connecting the contact members to the conductor bar and returning them, together with the armatures, to their normal position. The accompanying illustrations show the principles of the system quite well.



CONTACT MEMBER AND LONGITUDINAL SECTION THROUGH THIRD RAIL.

All exposed parts of the third rail are out of the circuit, or "dead," and are only energized or "alive" when a magnetic contact shoe rests upon them; and by placing the rails in the middle of the car tracks the only live rails will be underneath the car, thus making the system devoid of the danger of the live third-rail system.

The most important feature claimed by the manufacturers is the possibility of very high voltage which would result in a large saving of copper and a considerable saving in substations. Other advantages claimed are the saving of wooden boxing of rails, fencing in of tracks as a protection against shocks, and, as there is no loss of current from the rails to the ground on account of dampness, the rails always being out of circuit except on contact, the cost of maintenance is reduced. Regarding the cost of installation, it is claimed by the company that it is no more than the covered live rail. It is also claimed that good contact is possible between shoe and rail even when covered with snow or sleet, because of the large surface that is covered by the shoe, and the magnetic action, which has a tendency to increase the friction.

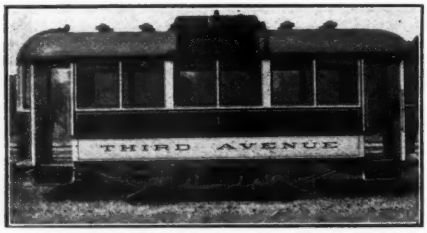
Electrical engineers of prominence have thoroughly examined the actual size model, showing the electrical and mechanical action under power as it would be installed on a railroad, also a running car of fair size on a circular track, that has proved the practicability of the system.

The Kozesnik company contemplates manufacturing every part of this system in its own factory.

A Gas-Electric Motor Car for the Third Avenue Railway Company, New York City.

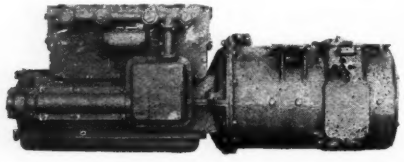
The General Electric Company has completed the construction of a single-truck car for the Third Avenue Railway Company, of New York, which is driven by a totally enclosed gas engine mounted between the axles. As shown in the photograph, the car resembles in many respects the short cars on many of our city railroads, and in operation can scarcely be distinguished from an ordinary electric car.

The gas engine has a four-cylinder, four-cycle engine direct-connected to a



GAS-ELECTRIC MOTOR CAR FOR NEW YORK.

generator and exciter, and the electrical energy thus developed is transmitted to two railway motors mounted on the axles. The car is operated from either end by an electrical controller, in the same manner as a trolley car. The controllers on each platform connect the motors progressively in series and in parallel, and regulate the voltage supplied to the generator, as required by the speed of the car. In this way all mechanical connections between the gas engine and the driving axles are eliminated. The gas



GENERAL ELECTRIC ENGINE DIRECT-CONNECTED TO GENERATOR.

engine, provided with automatic centrifugal throttle governor, runs at constant speed, regardless of the speed of the car, and thus operates at all times at high efficiency. The operator has no auxiliary levers for controlling the gas engine or the car.

The Bosch low-tension magneto supplies the ignition system, which is of the "make-and-break" magnet plug type. The engine is started by a crank direct from the magneto.

The exciter referred to above supplies current for the main generator field and for the lighting of the car.

The car has no monitor, its roof being dome-shaped with suction ventilators. Water-cooling radiators are placed on the roof, over the center of the car, and are connected to the water-jackets of the cylinders by pipes enclosed within the center posts of the car. The circulation is semi-siphon.

The following are some of the general dimensions of the car:

Length over all	28 feet
Length of body over end frames	19 feet
Wheel base	7 feet 6 inches
Height rail to top of roof	12 feet
Width over all	8 feet
Seating capacity	26
Weight complete, equipped	12 tons

The truck is of special light construction of riveted plate frame, equipped with Hess-Bright ball-bearing journal boxes. The truck frame is supported on coil springs and is steadied by half-elliptic springs at the ends of the truck frame.

Coal Dust as Fuel.

Among the difficulties encountered in designing a boiler to use dust as fuel, says the *London Times,* are those of securing a continuous and steady ignition, of employing a material to withstand the destructive temperature necessary in the furnace, of maintaining a homogeneous mixture of fuel dust and air during the full period required for complete combustion, and of handling the molten ash.

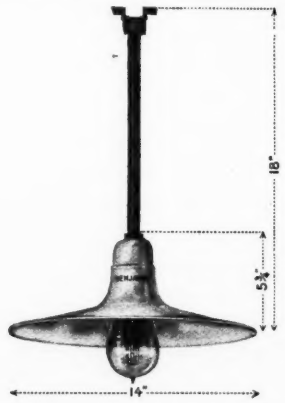
In the Bettington boiler made by Messrs. Fraser and Chalmers a vertical gas-jet inlet is employed, so constructed that a mushroom-shaped flame is produced within a line of water tubes which are part of the steam-producing plant. Otherwise only the ordinary firebrick and metalwork are employed as material. The combustible mixture enters the gas along the central axis of the furnace. The continuous ignition of the incoming stream of dust and air is effected primarily by the enveloping sheath of the products of combustion, and ignition is made independent of the incandescent brickwork. The furnace is stated to keep itself clear of slag at all rates of combustion.

At the Erith works of Messrs. Fraser and Chalmers a boiler of this kind has been in operation for some months. It has 2,200 square feet of heating surface, with a single twelve-and-three-fourth-inch tuyère fed with pulverized coal and air by a fan below a ball-mill pulverizer. Its calculated capacity was 7,000 pounds of steam per hour, but it has actually worked up to 15,000 pounds.

Benjamin Reflector Sockets.

The Benjamin Electric Manufacturing Company, of Chicago, is placing on the market a device known as the Benjamin Reflector Socket, which should eliminate much of the inconvenience caused by removing and installing lamp reflectors.

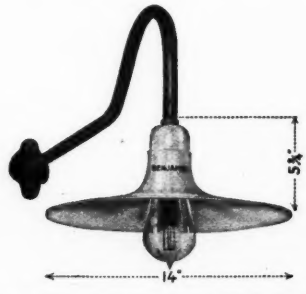
This socket consists primarily of a deeply hooded fourteen-inch enameled steel reflector fitted with a threaded brass



BENJAMIN REFLECTOR SOCKET COMPLETE WITH STEM.

bushing, tightly clamping the reflector between two leather washers, and a two-part porcelain receptacle of special design. The construction of the reflector and socket is such that connections can be easily made.

In the accompanying illustrations are shown two complete Benjamin outfits consisting of fixtures, sockets and reflectors. While the socket and reflector



BENJAMIN REFLECTOR SOCKET COMPLETE WITH GOOSENECK ARM.

sets are supplied separately, the outfits shown are particularly adapted for general service, namely, the thirty-inch gooseneck for outdoor service and the set with an iron pipe, brass casing, canopy and shock-absorber for indoor service.

A Chance for the Electric Furnace.

In a recent number of *American Industries* a photograph is given of an immense scrap heap of iron and steel at San Francisco., Cal., a relic of the recent earthquake and fire.

Storage Battery for a Crane Load.

An electric crane equipment of peculiar interest, recently installed at Southampton, Eng., is described in a recent issue of *Electrical Engineering,* of London, Eng., to which publication we are indebted for the following description and illustrations:

The feature of the arrangement is that a storage battery is employed to take off the peaks in the load, and enable it to be dealt with by a comparatively small generating plant. The installation consists

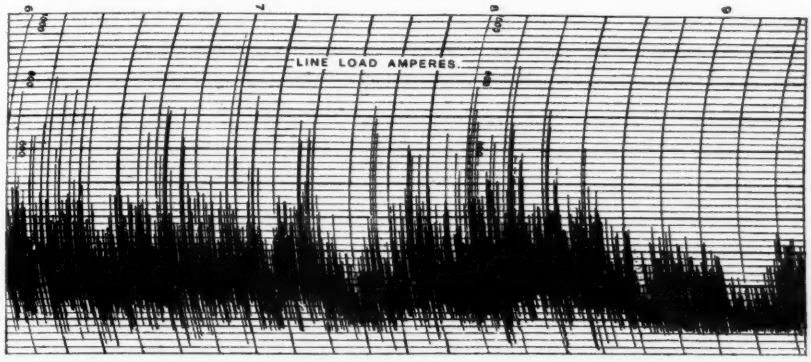


FIG. 1—CHART OF LINE LOAD, SHOWING FLUCTUATIONS BETWEEN 0 AND 800 AMPERES.

of a number of electric cranes, which have replaced the hydraulic cranes previously employed. They are equipped with grabs of a special type, with a capacity of one-and-one-half tons each, and are capable of loading and unloading at an average rate of one ton per minute. The cranes, when working simultaneously, take an average current of 250 amperes, at a pressure of 500 to 525 volts. The consumption per ton is said to be about 0.5 unit. The fluctuations in the load are necessarily severe, the current varying within short intervals from 0 to 800 amperes. With the aid, however, of a battery and reversible booster, this load is very successfully dealt with by one 150-horsepower producer-gas engine—another similar engine being in reserve. The engines are direct-coupled to generators capable of an output of 192 amperes at 520 volts, with a fifteen per cent overload for half an hour. It is stated that the coal consumption with the engines working at full load in one-and-five-tenths pounds per kilowatt-hour.

The battery consists of 245 cells of the "D.P." Battery Company's standard "L.S." fifteen-plate type, in wood lead-lined boxes, capable of discharging at 500 amperes for one hour, or at 1,000 amperes for short periods. The positive plates are about half an inch thick, and very solidly constructed to stand the heavy rates of charge and discharge. The formation of the plates is the "D.P." Battery Company's special Planté process, and consists of a thin hard skin, which is claimed to be practically proof against disintegration. The cells are burnt up throughout, and the inter-row and terminal connections consist of one-inch-diameter copper rod. The battery is erected on single-tier stands, mounted on concrete blocks. The booster, made by the Lancashire Dynamo and Motor Company, is so adjusted that the engines can be set at any desired load, and all variations above or below this load are taken care of by the battery and booster. Some records taken at this station are shown in the accompanying figures. From these it will be seen that with the line load fluctuating from zero to 800 amperes, the variation in the generator load was only about fifteen amperes above and below the mean. The generator was shut down for ten minutes, and during this time the battery supplied the whole load.

The connections of the switchboard are so arranged that the battery can be put on to the line by itself, or in parallel with a generator. As an alternative arrangement, the battery and booster can take the load without the generators, the booster being adjusted so as to give an over-compounding effect. The battery and booster can also be put on the line in parallel with both generators. In the unlikely event of both sets being temporarily disabled, the battery could, we are informed, keep all the cranes going for over three hours, so that the station is amply safeguarded against an interruption of supply. Besides the advantages in respect to reliability gained by installing storage batteries, a very considerable economy is said to be effected in the size and first cost of the whole generating plant, in addition to the saving in daily working expenses and wear and tear of the plant. The gas engines and generators were supplied by the British Westinghouse Company, Ltd. The battery, booster, switchboard, and cables were installed by the "D. P." Battery Company, Ltd., and the whole installation was designed by Lacey, Sillar & Leigh, consulting engineers, 78 King Street, Manchester, Eng.

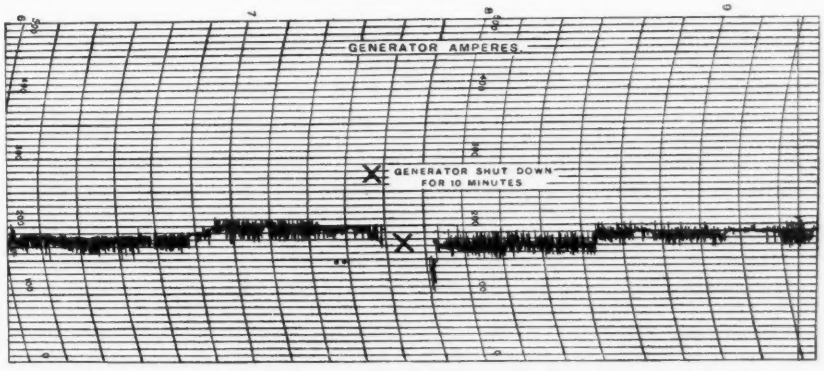


FIG. 2—CHART OF GENERATOR LOAD, SHOWING FLUCTUATIONS OF ONLY 15 AMPERES ON EITHER SIDE OF AVERAGE LOAD.

Telephone Train Dispatching on "Nickel Plate" Railroad.

The New York, Chicago & St. Louis Railroad Company is planning a telephone train-dispatching equipment for its line from Conneaut to Bellevue. This circuit will be the first one installed by the New York, Chicago & St. Louis, and if it proves satisfactory the railway company will in all probability equip its entire line with telephone train-dispatching apparatus.

The total length of the line is 132 miles, and there will be twenty-eight regular station equipments, with a number of special siding telephones so located that the train crews can get in direct communication with the dispatcher. The equipment used will consist of the standard Western Electric telephone train-

dispatching apparatus and Gill selectors. The siding telephones will be mounted in telephone booths which will offer shelter for the train crews when reporting to the dispatcher, or receiving orders from him. Arrangements are made so that the telephone sets at these sidings are automatically cut free from the line when the telephone sets are not in use.

The telephone train-dispatching apparatus which has been installed on the large railroad systems throughout the country has been giving such satisfactory service that there is little doubt that the equipment installed by the "Nickel Plate" will result in the system being installed over the entire line of the New York, Chicago & St. Louis Railway.

Electrically Heated Oil Tempering Bath.

The coil tempering bath is very largely used by manufacturers for the purpose of tempering steel tools or dies. It has been common practice to heat the bath by gas; but as very close regulation of temperature is essential for a uniform quality of product, gas heating has not proved satisfactory. Added to this is the ever-present fire hazard, due to the excessive heat possible when gas is used.

As is often the case, the use of electricity has been advocated as a solution of the problem of proper oil tempering; and the General Electric Company has recently perfected an electrically heated oil bath which seems to meet all the requirements of such apparatus. The general appearance of this device is shown in the illustration.

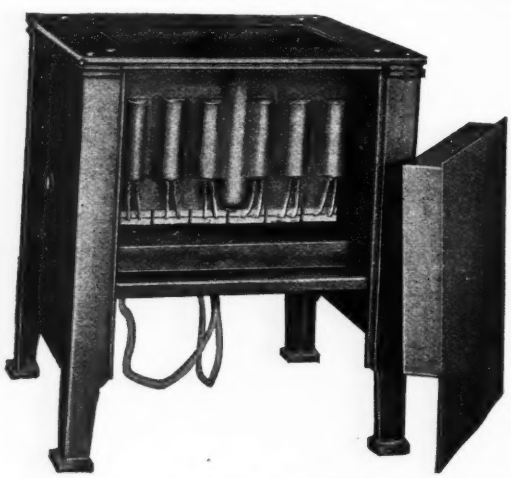
The bath proper consists of a cast-iron tank, or pot, having twelve lugs evenly spaced around the sides. These lugs are drilled to receive standard cartridge units, and it is found by thus distributing the units that an even temperature can be maintained in all parts of the oil. Around the pot is placed a heat-retaining jacket consisting of an inner and outer wall of sheet metal, the space of three inches between the walls being filled with mineral wool. The jacketing on each side of the pot is easily removable, thus allowing quick access to the internal connections of the units. Around the top of the pot there is a wide flange, to which are secured four cast-iron legs. A drain pipe, controlled by a globe valve, provides a means for drawing off the oil. There is a protected recess in one end of the pot, in which a thermometer can be placed to indicate the temperature of the oil.

There are two methods of using the oil bath. In the first method the temperature of the oil is raised to about 250 degrees Fahrenheit, the work placed in the bath, and full heat turned on. When the oil reaches the desired temperature, the work is removed and the current turned off. This method requires a single-heat bath. The second method is to turn on full heat, bring the oil to the desired temperature, then introduce the work, and by means of regulating switches maintain that temperature constant any length of time desired.

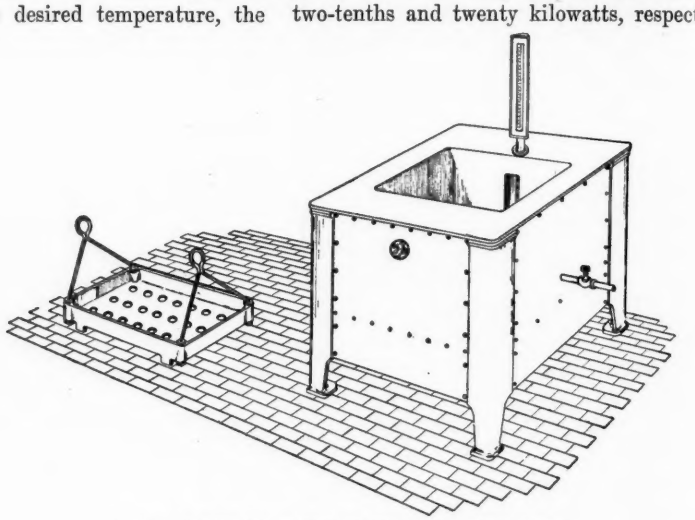
Where desired, a cast-iron basket or tray is supplied in which the work can be placed. The basket has eyebolts at each end to facilitate handling. The bottom of the basket is perforated with seven-eighth-inch holes, permitting free circulation of the oil. There are also legs on the bottom of the basket which keep the work an inch or more above the bottom of the bath.

The heating units are connected in groups according to the size of the bath, and the leads are brought out to the thermal block. In the single-heat devices, each group is protected by a fuse. In the multiple-heat device, the leads are carried to the switchboard, the latter being so arranged that the energy input can be varied in small steps from zero to maximum. A switchboard is not necessary for the single-heat bath, but is required where a multiple heat device is wanted.

Any desired temperature is obtained by throwing in the necessary number of units to give the approximate value. Close regulation is then secured by varying the voltage impressed on one of the units. This is accomplished by means of the rheostat mounted on the board. As a result of this method, there is a negligible loss of energy in the regulating device. The bath is made in three sizes of nine, eleven and thirty-seven gallons of oil capacity and consuming six, seven-and-two-two-tenths and twenty kilowatts, respectively. The energy consumption is sufficient to heat the oil to a temperature of 450 degrees Fahrenheit in less than one hour, starting cold.



GENERAL ELECTRIC OIL TEMPERING BATH.



OIL TEMPERING BATH WITH TRAY REMOVED.

May Use Barge Canal Reservoirs for Power.

While the barge-canal laws prohibit the use of water from its reservoirs for power purposes, there is a possibility of an amendment in the near future. It would be especially advantageous to use power from the Hinckley reservoir, as this will have at times a great surplus flow which must otherwise be allowed to waste back into the river.

The Hinckley reservoir is to cover an area of about four-and-one-half square miles and will have a capacity of approximately 7,445,000,000 gallons.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 28.—The government has at last appointed a committee to consider the revision of the special rules framed six years ago relating to the use of electricity in mines, but it is doubtful whether the constitution of this will prove very acceptable to what may be termed the working portion of the mining community. The committee consists of the present chief inspector of mines and the present electrical inspector of mines, together with Mr. C. H. Merz, of London power scheme fame and also noted in connection with the progressive power companies on the Tyne. A good deal of power supply is given by the Tyne power companies for colliery working, but the point raised against the introduction of electrical men as officials is that they do not understand the working conditions in the mine, inasmuch as they have never studied the practical side of mining apart from the application of electrical apparatus to mining operations. Complaint has been publicly made that the present permanent electrical inspector of mines, who was only appointed a comparatively short time ago, had never been down a mine until after his appointment, and dissatisfaction is bound to be expressed in the same direction at the appointment of Mr. Merz, eminent electrical expert though he be. However, evidence is to be called from the working electrical engineers who have charge of the plant underground and their views will undoubtedly carry much weight with the committee.

The high courts have this week decided that the Kohler patents for the operation of printing presses by electric motors is not an infringement of the Clatworthy patents, for the reason that the latter were anticipated by an American patent published in 1882. Descriptions of plants erected under this latter patent were published in "The Western Electrician" and "The Electrical Engineer" at the time and the judge held that the principle embodied in the Clatworthy patent was covered by the American patent. Both patents employed a small motor to start the presses and this was overtaken and automatically cut out by a heavier motor which maintained the working of the press afterward. In the American patent the two machines were mechanically connected in parallel, but in the English patent they were connected in series. The judge held, however, that this did not constitute a fundamental difference and either system could be adopted merely as a means of saving floor space. There was no advantage, in other respects, of one over the other. The material clause in the English patent was held to have been already covered by the American patent, and the action for infringement was dismissed with costs. Printing presses on the Kohler system are in operation in the offices of the "Daily Mail" and the "Times," among others. Notice of appeal has been given.

Another electric power station has been added to London's already long list. The Stepney Borough Council, in 1907, found itself face to face with the question of extending its plant and at that time the London bulk supply schemes were before Parliament. The Council entered into an agreement with one of the proposed power companies for a bulk supply at a very low rate, but as the bill did not pass through Parliament the Council was forced to consider the erection of a new power station for the reason that their existing one was incapable of extension. The new structure has been built upon the River Thames at Limehouse, and was set working this week. A feature of it is that the buildings are the first steel and ferro-concrete structures to be sanctioned by the London County Council. This may sound somewhat astonishing to American engineers. Under the old Buildings Act the Council could not pass such a building, but last session an amending clause was added.

The General Electric Company is taking action in the police courts to restrain the Welsbach Incandescent Gas Light Company from calling the latter's new metal-filament lamps by the name of the "Aur" lamp. The reason for this is that the name "Aur" has been generally adopted for the metal-filament lamps made by the German "Aur" Company, with which Baron Welsbach was associated. The lamp now being offered to the public by the Welsbach company here, it is claimed, is neither the invention nor the manufacture of Baron Aur von Welsbach, and if this is proved it is an offense against the Merchandise and Trade Marks Act. The case is likely to proceed for some little time.

Railless electric traction is still very much to the fore. At present, any corporation or company desiring to adopt the system has to incur the expense and delay of promoting a special bill in Parliament. The suggestion has now been made that the Board of Trade should be authorized to grant licenses for the use of the system, a proposal which, if carried out, will greatly simplify matters.

The Electric Lighting Acts (Amendment) Bill has at length passed through Parliament, the process of amendment which has dogged its course from its birth, pursuing it unto the last stage. Generally, the industry is satisfied at having gained something after six years' struggle with the politicians, but there is by no means general satisfaction. In fact, the municipalities, who were deprived of their wiring powers owing to a difference between the House of Lords and the House of Commons, have proposed the promotion of a bill next session in order to get these powers. At present the law is very inconsistent upon this point, many municipalities having powers to undertake wiring work and many others not. As usual, however, it is the friction among themselves which kills all attempts at co-operation between the municipalities in Great Britain.

A curious deadlock has arisen in London with regard to linking up two stations belonging to one electric supply company. Under the London Electric Supply Act of 1908 powers were given to companies to link up their undertakings in order to get the full benefit of the many power houses which have been built. This may be regarded as one of the chief objects of the Act. The County of London Electric Supply Company has one power house in the south and another in the north of London without any interconnecting main. Previous to the act it had no power to lay such a main. It now desires to take advantage of the terms of the act and to lay a main between the two, but the City of London Comporation, through whose territory this has to pass, refuses to give its consent for the roads to be opened, the reason given being that it would cause too great an interference with traffic. Under the act, also, the London County Council, as the purchasing authority of the company, has to consent to any such works, but without any greater reason than that the city of London refuse to consent, the London County Council also refuses its consent. Thus the company is forced to appeal to the Board of Trade to send the matter to arbitration, and we have the spectacle of two public bodies obstructing the putting into force of an act which was proclaimed by everybody as containing the one essential to the success and cheapening of electric supply in London, viz., intercommunication between the scattered systems. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 29.—In the southwestern region of France there is being developed an extensive electric traction project. The various lines which are to be built will connect Bayonne with the localities of Regrehorade and St. Jean Pied de Port, this latter point being situated in the Pyrenees region. In order to secure a supply of current for these lines, as well as for new tramway lines which it is also expected to install at various places, plans are being made to erect two electric plants, and these will be among the largest in this part of the country, as these plants will have a total of 10,000 horsepower capacity. About 2,000 horsepower will be needed for the different tramways.

A motor-operated cable incline was opened for service during the month of October in the town of Grasse. The electric outfit was installed by the Alcott Company, of Paris, while the mechanical part and structure was erected by the Berne Iron Works. The cable drum is operated by a seventy-five-horsepower motor, using current which is brought over a power line from a plant controlled by the Marseilles Enterprise Company.

During October there was also put in service an electric railroad line in Austro-Hungary which ranks among the large lines in that country. It has various sections and these make up about forty miles length. The whole system is known as the Trient-Malé railroad line. A part of this road, lying between Trient and Cles, had already been opened about the middle of September. It uses the trolley system, working on 800 volts direct current, and the electric outfit is supplied by the Austrian Siemens-Schuckert firm. The electric line was installed under the general direction of the Railroad Construction Bureau at Vienna. In connection with the electric road there is operated an electric plant known as the Sarca electric station, and it is situated about fifty miles distant. The alternators of the plant are operated on 20,000 volts and when fully installed it will have about 8,000 kilowatts capacity. This plant was opened last August and it furnishes current for the electric railroad, as well as for the town

of Trient and other localities. At the same time, provision has been made for a supply for new electric railroads which are planned. As to the present line, it is fed from three substations, one of which is located at Pressano. Each of these has an output of transformers and two three-phase direct-current rotary converters, together with a storage battery. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 6.—The city of Guelph, Ont., gets a profit of over $5,000 this year from the municipally-owned street railway, after paying all expenses.

The gross earnings of the Toronto Street Railway for the ten months of the current year total $3,189,868, showing an increase of more than a quarter of a million dollars over the same period last year.

Financial institutions of the city of Hamilton, Ont., whose signatures are on the petition asking the Dominion government to disallow the Ontario hydroelectric act, say that they have received an intimation that the matter will be dealt with before the end of the month, and their request probably granted.

What is believed to look like the first move in the Niagara power fight, is the application just made to the Parliament of Canada for a charter for the London & Lake Erie Railway Company, capitalized at $2,000,000, to operate a line between Brantford and London, running through Paris, Ingersoll and Woodstock, and with running rights over the line already built from Brantford to Hamilton. This is understood to mean that electric energy will be taken from either the Electric Development Company or the Cataract Power Company, which will be in a position to compete with Niagara power.

The directors of the Electric Tramway Company, of Halifax, N. S., have increased the dividend of the company from a six per cent annual basis to seven per cent. The stock of the company is strong at 118 bid, with none, however, offering. Halifax electric is regarded as very attractive at this figure. It is a comparatively low price for a public utility paying seven per cent dividends.

The town of Port Arthur, Ont., has carried the hydroelectric power by-law. In the face of a strong fight put up by James Conmee, M. P., who claimed he would be able to deliver power from Nepigon at a lower rate than the hydroelectric commission, the ratepayers accepted the commission's contract, by a vote of three to one. The commission will at once award the contract for the erection of the transformer station and equipment at Port Arthur, at a cost of about $60,000.

The Canadian Pacific Railway Company has now completed the installation of the telephone, to replace the telegraph, in the despatching and operation of trains practically all the way from Sudbury, Ont., to Brantford, Man. This embraces about the whole of the Lake Superior division, and as this part of the system, particularly that which lies along the north shore of Lake Superior, is a hard one to operate in winter, the substitution of the telephone for the telegraph shows the confidence of the managers and engineers in the greater efficacy of the telephone in the operation of trains. It is now declared to be only a question of time that the telephone will be utilized all the way from coast to coast.

The new power house of J. R. Booth, at the Chaudiere Falls, Ottawa, will be completed in about a month. The electricians are now employed installing the two new generators supplied by Allis-Chalmers-Bullock, Limited. Each generator will develop 3,000 horsepower. The generators will be driven by new model turbine waterwheels made by an American firm.

The gross earnings of the Montreal street railway for the year ended September 30 amounted to $3,874,838. The net earnings were $1,229,676, or over twelve per cent on the common stock of the system. The surplus for the year is $253,344. In 1900, nine years ago, the gross earnings of the road were $1,769,904. During the year the road carried a total of 127,661,000 passengers as compared with a total of 121,089,000 passengers carried the year previous, and 56,557,000 in 1900. The earnings of the road during the past year per passenger were about three cents.

The company, composed of American and Canadian capitalists, which for two years past has been seeking authority from the Dominion government to develop the waterpower at Long Sault Rapids, in the St. Lawrence River, near Cornwall, has submitted to the government revised plans that, it is hoped, will obviate previous objections as to interference with navigation on the river. The company is an amalgamation of the St. Lawrence Power Company, Canada, which has a charter to develop power on the Canadian side of the river, and of the Long Sault Development Company, which has a charter from the New York Legislature to develop power on the American side.

The project contemplates the damming of the river at the foot of the rapids, thus raising the river and creating a new channel for boats, which now use the Canadian canal at Cornwall. A very large amount of power could thus be developed. The company claims that, under the plan as now proposed, navigation would be improved rather than injured. The new channel, which would be created in American waters, in the south side of the island, near Cornwall, would have sufficient depth for all boats on the river, and a new lock would be built by the company. The new proposals will be examined by engineers of the departments of canals, marine and public works here. Shipping men at Montreal, however, will oppose the scheme. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

GREAT CACAPON, W. VA.—The Hydroelectric Developing Company, recently incorporated with $100,000 capital stock, is planning a hydroelectric plant at Edes Fort, on the Great Cacapon River. The machinery will include four 4,000-horsepower vertical turbines direct-connected to high-voltage vertical type generators.

TRENTON, N. J.—Articles of incorporation have been filed at Trenton, N. J., for the Great Falls Power Company, with an authorized capital stock of $17,000,000. The object of the corporation is to acquire and deal in water, water rights and power and to generate electricity for all purposes by waterpower. The capital stock is divided into $10,000,000 preferred, bearing seven per cent cumulative dividends, and $7,000,000 common. The incorporators are W. C. Parker, L. J. Relyea and F. W. Griswald, and the registered office is at 76 Montgomery Avenue, Jersey City, the address of all the incorporators.

CHICO, CAL.—H. O. Lague, manager of the Feather River Power and Development Company, has recently filed papers appropriating 1,000 inches of water from Little Fall Creek and 2,500 inches from the Little North Fork. The water in each case is to be diverted by a dam 200 feet high and carried by ditches to the middle fork of the Feather River, where preparations are being made for the erection of three power plants. The proposed plants will, it is stated, produce a total of 86,000 horsepower, the drop secured being about 3,000 feet, and the volume of water ranging from 15,000 to 25,000 miner's inches.

AUGUSTA, ME.—Work is being pushed on one of the largest artificial reservoirs in the world, located two miles from Wilson's Mills, on Aziscoos Falls on the Magalolway River, a tributary of the Androscoggin. This work is being done by the Androscoggin Reservoir Company, which received charter rights from the Legislature of 1909. The president of the company is A. N. Burbank, of New York. When this work is finished in January, 1911, it will make a new lake about twelve miles in length, containing 8,000,000,000 cubic feet of water. At the present time a total of 125,523 horsepower is used along the river during the day hours.

MEXICO, MEX.—The Hydroelectric and Irrigation Company has obtained control of the Compañia Tranvias, Luz y Fuerza, of Guadalajara, and is building a great new plant on the Santiago River twenty-four kilometres from that city, where $2,000,000 worth of machinery is being installed. When this plant is completed it will be able to generate 120,000 electrical horsepower, with which the mining regions of Hostotipaquillo and Ezatlan will be supplied to operate their mills. Substations are now being built at these two places and half the line, a distance of over sixty-five kilometres, is now in operation, while the remainder is expected to be completed within the next two months.

OAXACA, MEXICO—It is planned by F. Zorrilla and associates, who own and operate the electric-light and power plant in Oaxaca, to erect a large hydroelectric plant in the mountains above Etla, one of the towns in this district, and to build transmission lines to the city of Oaxaca and the mining camps of Taviche, Ocotlan, Etla and and other places. The longest of these proposed transmission lines will be about sixty miles. The streams in the mountains where there is a water fall of 1,000 feet available will be harnessed for the purpose of generating the power. The initial capacity of the plant will be 10,000 horsepower, but this can be enlarged from time to time as the demands may require. The present plant of F. Zorrilla and associates in Oaxaca is operated by gas engines, with an auxiliary hydroelectric plant of 1,000 horsepower near Etla. It is expected that mining operations in this part of Mexico will be greatly cheapened by the introduction of this electric power.

LIGHTING AND POWER.

(Special Correspondence.)

ST. PETERSBURG, FLA.—An electric-light plant is to be installed here.

FESTUS, MO.—The city recently voted an issuance of $15,000 bonds for electric lights.

STANLEY, N. D.—The City Council will shortly install a complete street-lighting system. C.

RACINE, WIS.—The Standard Electrical Company is considering the enlargement of its factory. C.

GLASGOW, MO.—This city has voted bonds for the purpose of buying the electric-light plant. P.

MARTINSVILLE, VA.—The city has voted $35,000 bonds for the enlargement of the electric-light plant here.

GRANITE FALLS, MINN.—Prices on a waterwheel for the power house are being secured by the village clerk. C.

SAVANNAH, MO.—The city has voted the issuance of $7,500 bonds for the construction of an electric-light plant.

BEEVILLE, TEX.—The Beeville Light Company has been granted a franchise to install an electric-light plant. P.

DALHART, TEX.—S. E. Killen, of the Dalhart Ice and Electric Company, is to double the capacity of the plant. P.

DAVENPORT, IOWA—The Davenport Water Power Company has applied for a franchise to transmit electric power. C.

CUTHBERT, GA.—The city has voted an issuance of $20,000 bonds for electric-light and water-works improvements.

KINGSVILLE, TEX.—H. Delno, manager of the Kingsville Ice Company, is about to install an electric-light plant. P.

COLUMBUS, OHIO—The Fremont Power and Light Company has increased its capital stock from $350,000 to $750,000.

WHITESTONE, GA.—A hydroelectric plant is to be installed to transmit 700 horsepower to a marble works near here.

TYLER, MINN.—The contract for the erection of the electric-light and water building was let to Andreas Sorensen. C.

ANSONVILLE, N. C.—It is reported that an 8,000-horsepower hydroelectric plant is to be constructed here at a cost of $750,000.

GRAND FORKS, N. D.—It is proposed to take a vote on issuing bonds for $25,000 with which to improve the lighting system. C.

ALTURAS, CAL.—The Alturas Light and Power Company has had surveys made of a number of possible power sites in this county.

KINGMAN, ARIZ.—The Frisno Mines Power Company, operating near this city, will install an electric-power plant on its property. A.

TWO HARBORS, MINN.—The Fort Wayne Electric Company secured the contract for the installation of electric meters for another year. C.

MANDAN, N. D.—A one-story building, sixty-four by ninety, will be erected by the Mandan Electric Company, on Main Street, at a cost of $30,000. C.

EUGENE, ORE.—A deal has been consummated whereby the Willamette Valley Company will take over the Howard Electric Company, of this city. A.

OAKLAND, CAL.—An ordinance has been adopted by the Council granting the Great Western Power Company a franchise to operate in this city. A.

ALBUQUERQUE, N. M.—The Highland Electric Railway has been granted a franchise for the construction of an electric-light and power plant. P.

FARGO, N. D.—J. S. Webster has sold the exclusive right to the North Dakota Heat and Power Company on a new electric meter which he has invented. C.

CARTHAGE, IND.—H. O. Henley has been appointed receiver for the electric light and power plant of this city. The property will likely be sold to the highest bidder. S.

MENOMINEE, MICH.—The Menominee and Marinette Light and Traction Company has commenced the construction of the concrete substation for the new power plant. C.

WAYZATA, MINN.—The Lake Minnetonka Public Service Company is having plans prepared for a power plant to cost $20,000, including two gas-generating engines. C.

NAPA, CAL.—The directors of the Veterans' Home at Yountsville, Cal., have awarded a contract to the Snow Mountain Power Company for supplying power to the institution.

GILBERT, MINN.—The Council has taken bids for wiring and equipment for electric lights. A wire has been ordered run at once from the high school to the Gilbert location. C.

EUREKA, CAL.—The Eureka Electrical Company has been awarded a contract to install a lighting plant on Willow Creek near China Flat, for a mining company of Los Angeles. A.

COLUMBIA, S. C.—The Eureka Cotton Mills, of Lancaster, will be fitted throughout with electric power as soon as the steam plant can be removed and the electric apparatus installed.

BROOK, IND.—The Commissioners of Newton County have granted a franchise to the Gragg Brothers to construct and operate an electric-light line between Brook, Morocco and Foresman. The Gragg Brothers are now in the market for wire, poles and other material to carry out the plan of constructing this transmission line. S.

FOLSOM, CAL.—The Great Western Power Company is constructing a power line along the Sacramento-Folsom road for the purpose of supplying power to the Natomas Consolidated Railway. A.

RENO, NEV.—The Reno Power, Light and Water Company will construct a $1,000,000 power plant west of Reno, on the Truckee River, in order to increase the power furnished by the company.

OROVILLE, CAL.—The plant of the Great Western Power Company at Big Bend is now producing 100,000 horsepower of electricity and the long power line is conveying it to San Francisco Bay. A.

ST. LOUIS, MO.—The Laclede Gas Light Company, in which John I. Beggs is interested, contemplates the erection of an electric-light plant of its own for supplying office buildings with light and power.

CHADRON, NEB.—The power plant of the Chadron Electric Light Company, together with all machinery, transmission lines, contracts and franchises, is to be sold at public auction on Tuesday, November 16.

FORT PIERRE, S. D.—If the City Council can obtain a satisfactory proposition from outside parties to install an electric-light plant a franchise will be granted; otherwise it is proposed to install a municipal plant. C.

MARYSVILLE, CAL.—The work of construction on the new electric power line between this city and Meridian, in Sutter County, a distance of twenty miles, has been begun and will be completed as soon as possible.

SAPULPA, OKLA.—The Sapulpa Electric Light Company has been incorporated, with $150,000 capital stock, by George Willis, H. M. Adams, J. E. Kimball and Joseph Kergegan, all of Guthrie, Okla., and Charles F. Lane, Philadelphia, Pa.

SPOKANE, WASH.—The Washington Water Power Company, of Spokane, has completed arrangements with the Interstate Mining Company, controlled by Duluth parties, to furnish electric power for the Interstate property, west of the Hercules mine.

WALLA WALLA, WASH.—A big power plant is being erected by the Columbia & Walla Traction Company on the south fork of the Walla Walla River. The power will be used for the operation of the proposed Dayton-Wallula electric line. A.

SUTTER CITY, CAL.—The Pacific Gas and Electric Company has begun work on the construction of its power line from Terra Buena to this and neighboring towns. It is given out that power for lighting and other purposes will be available at this place by January 1. A.

TOLEDO, OHIO—The capital stock of the Fremont Power and Light Company has been increased from $350,000 to $750,000. This is the company which is constructing the mammoth dam and hydro-electric power plant, on the Sandusky River south of Fremont, Ohio. H.

COLONIAL BEACH, VA.—J. R. Benton, Philadelphia, Pa., and other capitalists will, it is reported, establish an electric-light plant at Classic Shore, one mile from Colonial Beach, in connection with the proposed electric railway from Quantico to Colonial Beach.

RONCEVERTE, W. VA.—It is reported that a 1,000-horsepower hydroelectric plant is to be built five miles from here, power to be furnished by Second Creek. B. F. Mann of Fort Springs, who has bought the site, expects to commence work on the dam early in the spring.

CITY OF MEXICO, MEXICO—The Mexican Light and Power Company is arranging to extend its power-transmission lines to the Pachuca mining district. The line is to be completed by July 1, 1910. It is one of the largest mining districts in Mexico and utilizes more than 25,000 horsepower.

ROANOKE, IND.—The Fort Wayne and Wabash Valley Traction Company has entered into a contract with the City Council to furnish current from the company's substation to light the city. The traction company is preparing to enter into similar contracts to light towns and cities along its entire system. S.

TOLEDO, OHIO—J. W. Harbaugh, special master in bankruptcy of the Consolidated Gas and Light Company, of Tiffin, Ohio, has reported to Judge Tayler, of the United States Court at Toledo, that the plant has been sold for $9,500 subject to a mortgage of 125,000. The sale has recently been confirmed by the court. H.

ZIHUATANEJO, STATE OF GUERRERO, MEXICO—The federal government has granted a concession to the Pacific Government and Concession Corporation, Ltd., of Victoria, British Columbia, to erect a hydroelectric plant near Zihuatanejo. This company owns a big tract of land near here, which it is develop-

ing. It will build three large dams for the purpose of storing the water of the rivers which pass through its property. An important feature of the enterprise will be the irrigation of about 50,000 acres of land.

GLOVERSVILLE, N. Y.—The Caroga Water Power and Construction Company, of this city, has been incorporated with the secretary of state to furnish electricity for light, heat and power in Ephratah, Johnstown, Gloversville, Fonda and Fultonville. The capital is $50,000 and Gloversville, New York and New Jersey capitalists are financing the enterprise.

FT. WAYNE, IND.—The Board of Public Works has awarded a contract to the Ft. Wayne Electric Works for the furnishing and installation of two new switchboards, a new oil filter and other electric equipment, at the municipal electric plant, at a contract price of $1,225. The board will soon ask for bids for the furnishing of a new boiler and lamps for next year. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SCOTTSBURG, IND.—The Cincinnati, Madison & Western Traction Company has ordered the final survey for a traction road connecting the above-named cities and will soon ask for bids for constructing the road and for material and equipment. S.

LA CROSSE, WIS.—The La Crosse Water Power Company will apply for franchises to enter La Crosse with an interurban line to run from Winona to La Crosse and thence to Sparta, which will cost $3,000,000. Similar franchises will be asked at Winona and Sparta simultaneously.

FT. WAYNE, IND.—The Board of Public Works has notified the Ft. Wayne & Wabash Valley Traction Company that the Board has examined the new cement poles set in various parts of the city for test purposes, and find them satisfactory. The company will proceed with their manufacture for replacing the present poles in this city. S.

LOGANSPORT, IND.—The Commissioners of Cass County have granted a franchise to the Indiana & Northeastern Interurban Company to construct a road through the county. This company has secured similar franchises through White and Jasper counties and will eventually be built into Chicago. The company's legal office is in Logansport. S.

NEW YORK, N. Y.—The Public Service Commission has adopted an order requiring the New York & Queens County Railway Company to double-track its line between Flushing and College Point, Long Island, and also in Flushing. Between Flushing and Jamaica it is required to lengthen the turnouts, or switches, so as to maintain a headway of five minutes during the rush hours.

ABERDEEN, OHIO—The Pittsburg, Pomeroy, Portsmouth & Cincinnati Electric Railway Company has made application to Council for right-of-way through Aberdeen. The company, which is backed by Pittsburg and Cincinnati capitalists, has already obtained the right-of-way through the various counties and towns along the north bank of the Ohio River to the Brown County line. Agents are now obtaining the consent of property owners through Clermont and Hamilton counties. The promoters promise to have the road in operation between Pittsburg and Cincinnati within three years.

WICHITA, KAN.—Force that will give much impetus to the growth of this city is the building of the lines of the Arkansas Valley Interurban Company. When the system is completed all the more important cities in western Kansas will be connected by quick electric service with Wichita. The company is capitalized at $2,000,000 and has forces of men already at work surveying and buying right-of-way. As soon as the way can be secured active construction work will be begun. The first line to be constructed will be to the Northwest from Wichita, to a Hutchinson connection.

OAKLAND, CAL.—The Southern Pacific Railroad Company has withdrawn its application for a franchise for an extension to its double-track electric railway on Franklin Street, and the Peninsular Railroad Company, which is owned by the Southern Pacific interests, has asked for a single-track electric street-railway franchise over the same street. The move is supposed to be due to the opposition of the property holders to the franchise and to the fact that by asking for a street-railway franchise the necessity of securing the consent of a majority of the property holders affected is avoided.

OSHAWA, ONT.—It is announced that a syndicate of Oshawa manufacturers will give Oshawa, Bowmanville and Whitby the railway accommodation they sought in vain from the Canadian Northern. The road—an electric one—will be known as the Toronto and Eastern line, a Dominion charter being asked for. The village of Pickering will also be served, and entrance to Toronto made via Agincourt. An extension may ultimately be run north to Lindsay. A forty-five-minute service between Oshawa and Toronto is promised. Construction will be financed entirely by local capitalists.

PORTLAND, ORE.—Following the sale of the greater portion of the capital stock of the United Railways of Portland, Ore., the active control of the company and of the Ruth Trust Company, a subsidiary organization, passed largely into new hands. T. L. Greenough, president of the company, will continue in that position and will continue a member of the Board of Directors, but the remainder of the board is new. The new members are: Charles D. Fullen, of Iowa; J. H. Hulbert, of Iowa, and A. C. Emmons, L. B. Wickersham and F. E Bowman, of Portland. Charles D. Fullen succeeds Joseph E. Healy as vice-president. L. B. Wickersham continues as chief engineer and general manager. A.

SOUTH BEND, IND.—Plans for a limited electric service between this city and Indianapolis have been completed by the Chicago, South Bend & Northern Indiana, the Winona Traction Company and the Indiana Union Traction Company. Only a gap of five miles of road awaits completion to carry out the arrangements. Those who attended the meeting to make the arrangements and prepare a schedule were: C. E. & Alfred Deitrick, of New York; Samuel Murdock, of Lafayette; J. W. Smith and A. L. Kitselman, of Muncie, all of whom are interested in the lines over which the new service will be inaugurated. S.

MILWAUKEE, WIS.—To construct the proposed line of the Milwaukee Western Electric Railway Company between Milwaukee and Beaver Dam will cost about $1,500,000, according to testimony offered at the hearing last week before John H. Roemer, of the Wisconsin Rate Commission. The main line from Beaver Dam to the Milwaukee city limits will be a trifle over fifty-five miles in length. The proposed spur from Sussex through Pewaukee to Oconomowoc will be ten miles long. Traffic estimates for the new line include 355,000 cans of milk annually; 32,313 tons of mixed freight; 8,287 tons of stock and 1,600 tons of other farm products.

ALBANY, N. Y.—The public service commission has received an application from the Otsego & Herkimer Railroad Company, successors to the Oneonta & Mohawk Valley Railroad Company, which was previously the Oneonta, Cooperstown & Richfield Springs Railway Company, for authority to issue $1,500,000 in common capital stock, for consent to issue first, second and third mortgages and for authority to issue $500.000 first-mortgage bonds, $300,000 in second-mortgage bonds and $700,000 in third-mortgage bonds. The road in question runs from Oneonta, Otsego County, to Mohawk, Herkimer County, with a branch to Cooperstown.

VINELAND, N. Y.—The Northern New York Construction Company has been formed here for the purpose of building a trolley between here and Bridgeton, the county seat. The directors elected are: George E. Stevenson, proprietor of the Baker House; B. F. Patterson, a trolley magnate of New York; Dr. G. H. Burgess, of Philadelphia; Frank Parvin, owner of Parvin's Muddy Run Pond, on the proposed line; H. C. Bartlett, former solicitor of the borough of Vineland, and T. H. Coggey, retired capitalist, of New York. G. E. Stevenson was made president, B. F. Patterson and Frank Parvin vice-presidents, T. H. Coggey secretary and H. C. Bartlett treasurer.

MOUNT CLEMENS, MICH.—If the plans of the Illinois Valley Construction are carried out Macomb County will, in the near future, be traversed by a system of electric roads that will open up a considerable territory now only accessible by wagons and automobiles. For several months parties of engineers have been running lines up and down and across the county looking for the most feasible route for a trunk line to the Thumb district on which the prospectors have cast envious eyes for several years and through and to which many lines of roads have gotten as far as the blueprint stage. The Illinois Valley Construction Company has decided upon a route from Detroit along the Center Line road through Warren, Sterling, Shelby and Washington, taking in the villages of Warren, Utica, Disco, Washington and Romeo in this county and from the latter point to Lapeer and into the heart of the Thumb district.

CHAMPAIGN, ILL.—Articles of incorporation have been filed with Secretary of State Rose by the Edwardsville Belt Railway Company, the line to be constructed from a point approximately one-and-one-half miles south of the center of the city of Edwardsville to a point approximately one-and-one-fourth miles northwest of that city; the capital stock to be nominally $2,500 and the principal office to be located at Champaign. The incorporators and first board of directors are: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble and C. E. Cox, all of Champaign. Articles have also been filed by the Decatur Belt Railway Company, the line to be constructed from a point at or near the intersection of Jasper and Garfield streets in the city of Decatur to a point approximately two-and-one-half miles west of the center of said city; the capital stock also to be nominally $2,500, the principal office to be located at Champaign. The incorporators and first board of directors are: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble and C. E. Cox, all of Champaign.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GRAND MARAIS, MINN.—The United Wireless Telegraph Company will install a station here. C.

MARMADUKE, ARK.—The Independent Telephone Company has been incorporated, with a capital stock of $2,000. P.

CROSBYTON, TEX.—The Crosbyton Telephone Company has been incorporated, with a capital stock of $10,000. P.

MAMMOTH SPRINGS, ARK.—Lehman Kay, of Salem, Ark., and others have purchased the Montgomery Telephone System, and will extend the lines. P.

FT. WAYNE, IND.—The Home Telephone and Telegraph Company has distributed a three-and-a-half per cent semi-annual dividend to common stockholders. S.

BURLINGTON, VT.—The Independent Telephone Company, of Montgomery, has been granted by the village trustees the right to erect poles and string wires in the village streets.

HARLOWTOWN, MONT.—Lewis Penwell, of Helena, M. N. Stevens, of Harlowtown, and others have incorporated the Meagher-Fergus Telephone Company, with a capital of $40,000. C.

MONTPELIER, VT.—Incorporated under Massachusetts laws, with a capital of $7,000, the Heath Telephone Company has filed papers with the secretary of state to begin work in Windham County.

DES MOINES, IOWA—Judge McHenry in this district court has refused the restraining order to prevent the consolidation of the Bell and Mutual telephone companies. Minority stockholders of the Mutual asked for the order, claiming the consolidation was in restraint of trade.

WATERLOO, IND.—The City Council has ordered Home Telephone Company to remove all of the company's poles from the business streets to the alleys. It is reported that the company will install new wire on the poles planted in the alleys and make other improvements. Dr. E. Shoemaker is president. S.

SEYMOUR, IND.—The Seymour Mutual Telephone Company has just issued its first yearly dividend of eight per cent. This company was organized a year ago by the Merchants' Association, as a result of a bitter telephone fight waged against the Seymour Home Telephone Company, which persisted on raising rates. The directors of the Seymour Mutual Company have decided to install some new equipment and extend the lines. S.

FOND DU LAC, WIS.—Arrangements are being made by the Wisconsin Telephone Company to establish a rural telephone system in the eastern part of the town of Friendship, or that part of the county lying between the Northwestern and Soo line tracks and the shore of Lake Winnebago. There are a great many farmers residing in the territory and it is believed that from seventy-five to one hundred telephones would be installed in the first year.

TACOMA, WASH.—The Puyallup Home Telephone Company has changed hands and the stock is now owned principally by Puyallup citizens. The new company is capitalized at $40,000. The officers are: S. W. Greenwood, of Puyallup, president and manager; W. D. Cotter, of Puyallup, vice-president; J. S. Gregg, of Seattle, secretary; W. A. Miller, of Puyallup, treasurer; W. A. Zalm, of Tacoma, engineer. The trustees elected are W. D. Cotter, C. L. Zalm, E. P. Truedson, J. S. Gregg and S. W. Greenwood.

ALBANY, N. Y.—The Cattaraugus Union Telephone Company has been incorporated, with a capital of $50,000, to operate in the counties of Niagara, Erie, Chautauqua, Cattaraugus, Orleans, Genesee, Wyoming, Allegany, Livingston, Steuben and Monroe. The directors include: Charles M. Beattie, William T. Farrell and W. Roy McCanne. The Allegany Telephone Company, organized to operate in Allegany County, was also incorporated, with a capital of $10,000. The directors include: Robert E. Lang, George J. Fisk and John B. White, of Belfast.

AURORA, ILL.—A project to obtain funds with which to make extensive improvements to local and toll line service and other work has been approved of by the holders of bonds of the Inter-State Telephone Company and may be adopted soon. The scheme will do away with the issuing of any more bonds or floating of further outside loans, it is said. The $175,000 or more interest on bonds of the company, due annually, will be waived, by the scheme now being discussed, the bondholders taking notes for interest money, allowing the entire sum for use in improvements at once.

CLEVELAND, OHIO—In a signed statement here James S. Brailey, Jr., has denied positively the rumor that he had sold the controlling interest in the United States Telephone Company to the Bell interests. Mr. Brailey added that the United States company would do everything in its power in behalf of the independent telephone interests, and that his object in gaining control was for the sole purpose of giving the independents additional protection. In an interview he said that he was in no respect opposed to the plan previously arranged, to lease the property of the United States Telephone Company to the Ohio Home Telephone Company, the new company organized by the independents at Columbus last week for this purpose.

PERSONAL MENTION.

H. E. HANCE has taken the management of the Mankato Electric Traction Company, of Mankato, Minn.

HAROLD EDMUNDS, of Yankton, has assumed the control of the electric-light plant of the Ferris Brothers system at Watertown, S. D.

L. M. BOISEN, formerly with the Grand Rapids-Muskegon Power Company, has accepted a position with H. M. Byllesby & Company, Chicago, as power engineer.

HARRY C. KENDALL has severed his connection with the Westinghouse Electric and Manufacturing Company, to become instructor in railway electrical engineering at the University of Illinois.

EDGAR I. WENGER has resigned his position as associate in railway engineering, University of Illinois, to accept one as assistant professor of electrical engineering, McGill University, Montreal, Que.

ARTHUR BESSEY SMITH, assistant professor of telephone engineering, Purdue University, has become associated with the Automatic Electric Company, Chicago, in the sales and advertising department.

G. A. BURNHAM, recently connected with the General Electric Company, in the engineering department, has accepted a similar position with the Condit Electrical Manufacturing Company, Boston.

S. N. FARNSWORTH has accepted a position in the transformer division of the Westinghouse Electric and Manufacturing Company. Mr. Farnsworth was formerly with the Underwriters' Laboratories in Chicago.

E. P. KENNEY, for several years assistant superintendent of the Waltham Gas Light Company, has recently taken the position of sales manager with the Niagara and Erie Power Company, of Buffalo, N. Y.

H. B. KIRKLAND, of the National Metal Molding Company, Pittsburg, has been enjoying a well-earned rest of a few weeks in Milford, Pike County, Pa., a county which is the home of wild animals, game and fish.

L. C. FRITCH, consulting engineer of the Illinois Central Railroad and recently in charge of the electrification investigations carried on by that road, has accepted the position of chief engineer of the Chicago Great Western Railroad.

H. WESTBURY, well known in the electric-lamp manufacturing field, is now associated with the American Miniature and Decorative Lamp Company as manager, and hereafter will be located at 304 Hudson Street, New York city.

JOHN T. HUNTINGTON, of Topeka, Kan., has assumed his duties as general manager of the Green Bay Traction Company, the Northern Hydro-Electric Company and the Green Bay Gas and Electric Company, all of Green Bay, Wis.

PAUL SHEEHAN, one of the night chiefs in the Western Union Telegraph office, 195 Broadway, New York city, died suddenly on November 2, at his home, 19 Eldert Street, Brooklyn, after an illness lasting several months. He had been in the Western Union employ for nearly forty years. A widow and four children survive him.

CHARLES P. HIDDEN has joined the firm of Rosenbaum & Stockbridge, patent attorneys and solicitors, 41 Park Row, New York city. Mr. Hidden is a graduate mechanical and electrical engineer and has devoted several years to practical engineering work. He is an attorney at law and for several years has been in the examining corps of the United States Patent Office.

FOSTER MILLIKEN, of New York city, formerly president of Milliken Brothers, Inc., has severed his connection as assistant to the receivers of that firm. For the past twenty-seven years Mr. Milliken has been one of the foremost and best known structural steel men in this country, and his work has also extended to nearly every foreign country in the world. Many of the present improvements in shop practice and design of structural steel work are due to his ingenuity. He is also the inventor of a number of patented articles that are used extensively. In 1902 he built the large bridge and structural plant at Staten Island, and in 1906 he designed and built the large open-hearth structural steel plant and rolling mills which bear his name. Mr. Milliken has no idea of giving up the very active career that he has followed for so many years, but he has not definitely decided on just what line of work he will engage for the future.

ELECTRICAL SECURITIES.

For the past week stocks have been very steady, with a continuation, in many cases, of the rise which has been the rule for some months past.

The recent rumors of telephone mergers and copper combinations seem to have had but little effect on the value of the telephone and copper securities. The steady resumption of activities on the part of the large manufacturing concerns is reflected in the better tone prevailing throughout the business market.

The traffic of the Metropolitan Elevated (Chicago) for October is estimated at 148,000 passengers daily, or an increase of 6,000.

The Northwestern Elevated's (Chicago) daily average traffic last month was 118,387 passengers, against 112,711 the previous month and 118,015 a year ago.

Directors and officers of the Chicago Railways Company, headed by President John M. Roach, have been re-elected for the ensuing year.

At the annual meeting of the Allis-Chalmers Company Stephen S. Palmer was elected a director, to succeed George Bullock, retired. Other directors were re-elected.

N. W. Harris & Company and the Harris Trust and Savings Bank have purchased $1,600,000 first-mortgage five per cent twenty-year gold bonds of the Oklahoma Gas and Electric Company, of Oklahoma City. The bonds will probably be offered in the near future.

An auction sale of $4,000 Chicago & Milwaukee Electric fives, due 1925, has been made at twenty-two. These bonds are on the Wisconsin division of the road. The 1919 bonds of the Illinois division are quoted on the curb at eighty-four bid.

Earnings of Boston Elevated for October made the best showing of any month since July. The increase in gross was approximately $52,000, or 4.2 per cent, compared with a September gain of $34,000, or three per cent, an increase in August of $46,000, or 4.1 per cent, and a July gain of $72,000, or six per cent.

The Northwestern Elevated, Chicago, will soon refund its four per cent bonds, maturing September, 1911, aggregating $22,482,000 outstanding, as the $3,000,000 block pledged against the loan was sold. Probably a four-and-one-half per cent issue will be substituted on the resumption of the elevated merger. Negotiations are expected at any time.

The 9,850 new shares of stock of the Old Colony Railroad authorized by the Railroad Commissioners, to be issued at $195 a share, is offered to the stock of record November 4, in the ratio of one new share for each twenty shares now owned. Subscriptions will be received until November 20, and payment in full is called for on or before December 18. Receipts will be given at time of payment which may be exchanged for new certificates at any time after January 10, 1910. Dividends on the new stock will accrue from January 1 next.

Brooklyn Rapid Transit continues to hold the remarkable gains in gross of the summer and fall months. For October gross increased $160,000, or $5,000 per day, which compares with daily gains of $5,000 in August and September. The percentage of increase is somewhat greater than in the summer months, as total gross receipts are naturally less at this season than earlier in the year. For the first four mnoths of the current fiscal year, which began July 1, Brooklyn Rapid Transit has gained $650,000 in gross passenger receipts, which compares with an increase of but $150,000 during all of the 1908-09 fiscal year, and $488,999 during the 1907-08 fiscal period.

DIVIDENDS.

Columbus Edison Company; quarterly dividend of one-quarter of one per cent, payable December 1.

Halifax Electric Tramway Company; dividend increased from a six per cent annual basis to seven per cent.

Pacific Gas and Electric Company; quarterly dividend of $1.50 per share on the preferred stock, payable November 10 to stockholders of record November 1. The first dividend on this stock, of one-and-one-half per cent, was paid April 15, 1906, and August 1, 1909, the dividends which had accumulated were refunded.

Tampa Electric Company, semi-annual dividend of $3.50 per share, payable November 15.

NEW YORK.

	Nov. 8.	Nov. 1.
Allis-Chalmers common	15¾	15⅝
Allis-Chalmers preferred	55⅛	52⅜
Amalgamated Copper	87¼	86⅛
American Tel. & Cable	*80	*80
American Tel. & Tel.	141	141¼
Brooklyn Rapid Transit	76½	75⅝
General Electric	163	163
Interborough-Metropolitan common	19¾	19⅝
Interborough-Metropolitan preferred	49¾	50⅛
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	93¾	91
Mackay Companies (Postal Telegraph and Cables) preferred	75½	75¼
Manhattan Elevated	141	141
Metropolitan Street Railway	23	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	91⅝	90
U. S. Steel preferred (ex. dividend)	126¾	127⅞
Western Union	78	76½
Westinghouse common	86⅝	86
Westinghouse preferred	140	140

*Last price quoted.

BOSTON.

	Nov. 8.	Nov. 1.
American Tel. & Tel.	141	141¼
Edison Elec. Illuminating	—	—
General Electric	163	163
Massachusetts Electric common	18½	18¼
Massachusetts Electric preferred	82¾	82
New England Telephone	134	134
Western Tel. & Tel. common	10½	10½
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 8.	Nov. 1.
American Railways	45¼	45½
Electric Company of America	12¼	12¼
Electric Storage Battery common	58½	58
Electric Storage Battery preferred	58½	58
Philadelphia Electric	13⅛	13⅛
Philadelphia Rapid Transit	27½	25¾
Philadelphia Traction	89	89½
Union Traction	53½	51¾

CHICAGO.

	Nov. 8.	Nov. 1.
Chicago Railways, Series 1	104	104
Chicago Railways, Series 2	34	35
Chicago Subway	7	7
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	17	16
Metropolitan Elevated preferred	54	50
National Carbon common	95¾	95½
National Carbon preferred	118¼	118

NEW PUBLICATIONS.

STREET-RAILWAY LAMPS—The National Electric Lamp Association's Engineering Department, located at Cleveland, Ohio, is sending out copies of its new Bulletin 5-B, devoted to descriptions and data of modern street-railway lamps. The tantalum lamp, which has been well known to have a longer life on direct current than on alternating current, has been improved materially for both classes of service of late, with the result that it has been found peculiarly adapted for electric railway lighting. This bulletin shows at some length many of the desirable features of tantalum railway lamps, and also gives data on carbon lamps for alternating-current railway equipments. Copies of this bulletin should be of considerable value to electric railway companies in giving them the most recent information regarding incandescent lamps for their peculiar needs.

FOWLER'S MECHANICS' AND MACHINISTS' POCKET-BOOK AND DIARY FOR 1910—The second edition of this useful annual diary and pocketbook, published by the Scientific Publishing Company, of Manchester, England, at the nominal price (in England) of six pence (twelve cents) has just been published. The book is remarkable for its practical character and its convenience for reference purposes. Although chiefly typical of English practice there is much in its make-up of a universal nature. A number of tables relating to the proportions of bolts, nuts, spanners, pipe (Whitworth) and fine screw threads, as well as to tolerances and allowances for various qualities of running fits, are reproduced from the reports of the (British) Engineering Standards Committee. The work has been prepared under the direction of William H. Fowler, editor of "The Mechanical Engineer," of Manchester, England, who is a well-known authority on all matters pertaining to mechanical and electrical engineering.

NEW INDUSTRIAL COMPANIES.

EVANSVILLE, IND.—The National Electrical Advertising Company has incorporated to manufacture an electrical advertising device. J. A. McCoy and C. P. Schule are directors. S.

BOSTON, MASS.—The Burton Cloth Treating Company has been incorporated to deal in patent electrical machinery, with a capital of $100,000. G. D. Burton, Boston, president, and L. Harris, Jamaica Plain, are the incorporators.

NEW YORK, N. Y.—The Odin Dry Battery Company, of Manhattan, has been incorporated to do business as electricians, manufacturing electrical supplies, with a capital stock of $25,000. Incorporators: B. Colby, Bronx; H. C. Adams, H. R. Berlinicke, New York city.

ALBANY, N. Y.—The Hooker Electro-Chemical Company, of Niagara Falls, has been incorporated with the secretary of state, with a capital of $3,750,000. The directors are Michael Gavin, Jr., Franklin Remington, of New York city, and Albert H. Hooker, of Niagara Falls.

LIGONIER, IND.—The Interstate Contracting Company has filed articles of incorporation, capitalized at $50,000. The company proposes to make a specialty of building and equipping electric railroads. William T. Abbott is the president, and D. T. Mohabb, secretary. S.

WILMINGTON, DEL.—The Pre-Heating Appliance Company has been incorporated to manufacture electrical devices. The capital is $500,000, and the incorporators are: W. S. Potter, B. L. Beck, New York city; W. B. Hutchinson, Newark, N. J., and H. W. Davis, Wilmington, Del.

INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw, Mich., dealers and manufacturers of machinery, are distributing the November stock list of metal-working machinery.

THE BOGART GAS POWER ENGINEERING COMPANY, Buffalo, N. Y., is distributing a folder containing views of installations of Bogart single-cylinder gas engines.

THE WIRE AND TELEPHONE COMPANY, of Rome, N. Y., has issued an attractive calendar card for November. It shows a beautiful flower girl and is printed in a number of bright colors.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has installed 150 motors in the plant of the Moline Plough Company, at Moline, Ill. The entire plant is now operated by electricity.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., is distributing the October number of its publication entitled, "Graphite." In addition to some very interesting reading matter, this issue contains much useful data.

THE AJAX LINE MATERIAL WORKS, Milwaukee, Wis., manufacturers of outdoor lighting specialties, is distributing a folder devoted to arc-lamp insulators, insulating cross-arms, tungsten street fixtures and lamp-posts.

THE WAGNER ELECTRIC COMPANY has recently issued Bulletin No. 88, illustrative of motor applications. This bulletin contains a number of excellent illustrations of motors applied to machine tools, and industrial process machinery.

THE ARNOLD COMPANY, Chicago, Ill., engineers, is distributing a post card containing two views of the Burnside Foundry Plant of the Featherstone Foundry and Machine Company, Chicago, for which it acted as engineers and supervisors.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is sending out an attractive pamphlet, No. 233, which calls attention to its line of electric hoists, shovels, winches, etc. A copy will be sent upon request to anyone interested in such apparatus.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing bulletins Nos. 3308, 3309 and 3137, descriptive of blowers for hot-air furnaces, electric forge blowers for direct and alternating currents, and single-phase induction motors, respectively.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has recently distributed a catalogue devoted to "opalux" glassware and containing facts and figures relating to the same. This company is also distributing a list of revised reduced prices on Columbia tungsten lamps.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., is issuing a little booklet calling attention to some of its products and incidentally containing an excellent story on the relations between a good old Irishman, a minister, and a lot of whisky bottles.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., is distributing a booklet descriptive of Aurola flaming-arc lamps. In addition to the descriptive matter this little booklet contains a description of the general construction of this lamp, together with diagrams and useful data.

THE PENTON PUBLISHING COMPANY, of Chicago, Ill., and other cities, publishes on the tenth of each month "Penton's List," a miscellaneous advertising sheet of several pages, devoted mainly to machinery and the iron and steel trades. The October list has recently been received.

THE DUPLEX METALS COMPANY, 149 Broadway, New York city, is distributing a circular calling attention to one of the many advantages of copper-clad steel trolley wire. This firm has moved to the thirty-second floor of the Singer Building on account of being crowded for space in its former location.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has recently distributed the November "bargain sheet," which contains a large number of electrical appliances and supplies at greatly reduced prices. This company is also distributing a circular devoted to a description of National Direct-Current Motors.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, Pittsburg, Pa., reports an excellent demand for its American enameled rigid conduit. This conduit is entirely approved by the Underwriters' National Electrical Association, and is made in all the standard and several special sizes. Circulars describing it can be obtained upon request.

THE STANDARD ROLLER BEARING COMPANY, Philadelphia, Pa., announces that the following directors were elected for the ensuing year at the recent annual meeting: Lenox Smith, William D. Shane, J. H. Clothier, W. B. O. Field, Edwin Packard, Herbert DuPuy, Edward B. Smith, John C. Winston, G. H. Martin, James Boyd and R. S. Woodward, Jr. These directors formally elected the following officers: Lenox Smith, president; W. B. O. Field, vice-president; R. S. Woodward, Jr., vice-president and general manager; W. M. Baldwin, secretary and treasurer.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the November number of its monthly publication, entitled "Trumbull Cheer." This issue is typical of the previous publications of the company in that it contains clever advertising intermingled with catchy stories and has a cheerful tone throughout.

THE LIBERTY ELECTRIC MANUFACTURING COMPANY, 543 Fourth Avenue, Pittsburg, Pa., the only manufacturers of all types of incandescent electric lamps in Pittsburg, was highly complimented in a reading notice appearing in a recent issue of "Commerce of Greater Pittsburg," a publication devoted to the interests of Pittsburg commerce.

E. J. BROOKS & COMPANY, 227-229 Fulton Street, New York, N. Y., is distributing a circular describing the Brooks' patent nailless box strap and seal with non-breakable metal straps in connection with the Brooks' patent strap-pulling device for sealing cases with straps. A sample of the strap and seal is sent out in connection with the circular.

THE LORD ELECTRIC COMPANY, of New York and Boston, has issued Bulletin M, which describes the new Heany multiple direct and alternating-current arc lamp. This lamp is of exceptionally simple and rugged construction, and should therefore prove particularly suited for places where hard service is apt to be imposed upon a lamp of this kind.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has recently issued its October bulletin, which contains several interesting articles, among which may be named the "O-B Suspension Type Porcelain Insulator for 110,000 Volts," and a description of the Pomeroy Coal Company's haulage system. In addition this bulletin contains some interesting and useful data.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued a folder entitled, "Make Your Head Save Your Hands." In this are illustrated and briefly described a number of applications of Wagner motors to various industrial purposes, such as the dough kneader, coffee grinder, printing press, ventilating fan pump and ice cream freezer.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has just issued Bulletins Nos. 42 and 43. Bulletin No. 42 is devoted to union electric semaphores equipped with style "S" mechanism. Bulletin No. 43 is devoted to facing-point switches and passing siding protections. Both of these publications contain data and diagrams that should prove valuable.

THE J. P. DEVINE COMPANY, Buffalo, N. Y., manufacturers of the Passburg vacuum drying and impregnating apparatus, is distributing circulars explaining these equipments. One of them gives "the long and short of it" and another one contains an extract from the report of the committee on equipment of the American Street and Interurban Engineering Association.

THE BOGART GAS POWER ENGINEERING COMPANY, Buffalo, N. Y., has issued a folder describing various types of gas engines manufactured by it. These engines, from the small twenty-horsepower single cylinder to the large five-hundred-horsepower double-tandem engine, are fitted with a special magnetic-electric igniter, for which remarkable properties are claimed.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has recently closed a contract with the United States Naval Department for three 100-kilowatt (2,300-volt alternating current, 115-volt direct current) motor-generator sets; two twenty-five-kilowatt exciter sets and a twenty-seven-panel switchboard. This apparatus is to be used in connection with improvements now being made at the Philadelphia navy yards.

THE FERGUSON PUBLISHING COMPANY, 114 Liberty Street, New York city, announces that it has purchased from the Gage Publishing Company "Steam," the monthly publication devoted to the interests of the steam trade. It will be published under the latter name, beginning with the current issue. The Architects' and Automobile Editions of "The Buyers' Reference" have also been purchased by the Ferguson Publishing Company.

THE NEW YORK POLE COMPANY, 277 Broadway, New York city, has recently distributed an attractive booklet devoted to methods of reinforcing metal trolley poles. This booklet contains information which should prove particularly valuable to electric-railway managers who have iron poles that are showing signs of corrosion at the ground line. Several examples are given wherein old trolley poles almost entirely severed by corrosion were made practically as good as new.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a catalogue devoted to the description of miniature electric railways. This comprehensive catalogue of electrical toys will be found of interest especially to those looking for suitable electrical Christmas gifts. This company is also distributing a circular entitled, "Economical Meter Tests Made

with P. M. Meter-Connection Blocks." This publication is a treatise on meter testing and gives full descriptions for testing all types of meters by means of the new P. M. system. It is claimed that the adoption of this system will reduce meter-testing expenses from fiftee nto forty per cent and will prevent theft of current.

THE NATIONAL X-RAY REFLECTOR COMPANY, 247 Jackson Boulevard, Chicago, Ill., has recently distributed Bulletin No. 2. This publication contains directions for planning installations using the "Eye-comfort" system of indirect illumination, and in addition tables, data and information which should prove of value to anyone contemplating lighting installations. The material presented in this bulletin was based on illumination tests made under various conditions, and consequently has a high practical value.

THE ALLIS-CHALMERS COMPANY has received a duplicate order from the Cleveland plant of the Cleveland Worsted Mills, Cleveland, Ohio, to be installed at their factory at Ravenna, Ohio. This will consist of a 1,500-kilowatt, sixty-cycle, three-phase alternator, direct-connected to a thirty-four and fifty-four by forty-eight of 100 revolutions per minute heavy-duty cross-compound Corliss engine. The necessary switchboard wiring and cables will also be furnished. The Geo. S. Rider Company are the consulting engineers in charge of the work.

THE AMERICAN STEEL AND WIRE COMPANY, Chicago, has recently issued a number of the W & M Telephone Wire News, containing several articles of considerable interest to telephone men. An account of some of the precaution taken to insure the manufacture of uniform wire, and an article on the "Preservation and Care of Poles" are well worth reading. A special feature of this number is a double page of engravings, showing more than twenty-five plants of the American Steel and Wire Company, from which the magnitude of this concern may be seen.

THE DARLEY ENGINEERING COMPANY, Singer Building, New York city, has prepared Bulletin No. 4, descriptive of its suction conveyor system. The bulletin explains the general principles and many of the details of this system, which is used principally for the removal of ashes from the pits of boiler furnaces. Illustrations are given of typical installations, showing both steam-driven and motor-driven exhausters, which provide the suction for drawing the ashes into the storage bin. There is also given a partial list of plants in which this suction system has been installed.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has issued two new publications. Handbook "L. V." relates to low-voltage lighting plants equipped with tungsten lamps and storage batteries. Handbook "I. P." relates to the use of the Chloride Accumulator in small isolated lighting plants. The former of these publications describes in some detail a comparatively new development in the isolated plant line, namely, that of using the more rugged and very highly efficient low-voltage tungsten lamp. This is peculiarly adapted to be used in connection with storage batteries and the pamphlet gives details of such installations with the switchboard and generator requirements as well as prices covering the complete equipment of the battery and switchboard.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, has prepared sample copies of its recommendations for improved illumination made by the engineering department of the company. Such recommendations are furnished free of charge, together with the service of the engineering department to those dealers and contractors who are co-operating with it in combining high-grade Tungstolier fixtures with artistic illumination. The company says that it is only necessary to send sketches with mentions of the areas it is proposed to illuminate and giving necessary information, and the engineering department will do the rest.

THE STAR EXPANSION BOLT COMPANY, of 147-149 Cedar Street, New York city, makers of the well-known Star expansion bolts, are adding a new safety device for hanging pictures, etc., securely, neatly and in an improved manner, to their products. This device is known as the Sebco Ready Fastener and consists of a wedge sharpened at one end, having a hole sunk, and threaded at the other. The wedge is driven in flush with the wall, the fixture placed, and a blunt-end screw is inserted into the threaded end of the wedge and fastened securely. Whenever it becomes desirable to remove the fastening, the screw is taken out, and the wedge being flush with the wall is not noticed. This product is being sold by picture-frame stores and by hardware dealers throughout the country.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has recently issued a new bulletin (No. 49) on toll-test panels, which are a great convenience, as well as a necessity in the operation of an up-to-date toll equipment in connection with a city local exchange. In this bulletin the uses of the different types are fully explained and illustrated, and a detailed description of the construction is given. A still more recent bulletin (No. 51) covers the subject of arresters. The different uses for arresters are fully explained and illustrations, accompanied by detailed description, are plentifully scattered through the bulletin. Code numbers are arranged for the different types to facilitate ordering. Brief directions for installing and connecting the arresters, illustrated by diagrams, are also contained in this bulletin.

DATES AHEAD.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15 to 25.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, O., November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS.. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frase, Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Perry-Payne Building, Cleveland, O.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 115 Adams Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 25 West Forty-second Street, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK. (Member National Electrical Trades Association.) Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, W. A. Wolls, Columbus, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West Thirty-ninth Street, New York city.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State Street, Boston, Mass.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe Street, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 2, 1909.

938,471. GROUNDING DEVICE OR TERMINAL FOR LINE-WIRES. William R. Garton, Brooklyn, N. Y. Filed November 12, 1908. A longitudinal rod binds together units composed of hygroscopic material.

938,501. ADDING-MACHINE. Frank R. McBerty, Evanston, Ill., assignor to Burroughs Adding Machine Company, Detroit, Mich. Filed February 27, 1904. An electric motor operates the driving member and a magnetic switch can close the circuit and keep it closed independently of a manually-operated device for the same purpose.

938,516. APPARATUS FOR RECORDING BELL OR LIKE SIGNALS, ESPECIALLY APPLICABLE TO MINES. John Russell, Langlaagte, near Johannesburg, Transvaal, assignor of one-half to John Hugh Milligan, Langlaagte, Transvaal. Filed January 27, 1908. The device for marking the record strip is electrically operated.

938,525. ELECTRIC MOUTH-MIRROR. Burton E. Turney, Bridgeport, Conn. Filed July 6, 1908. An electric lamp is provided near one edge of the mirror.

938,541. TELEPHONE-EXCHANGE SYSTEM. Charles L. Zahm, Los Angeles, Cal., assignor of one-fourth to Edward E. Clement, Washington, D. C. Filed September 19, 1905. Means actuated in the first motion of the selector switch are provided to display a signal and indicate that a connection is desired on the manual switchboard.

938,553. PRIMING CHARGE FOR MINES. Louis Cahüc, Neumarkt, Germany. Filed June 15, 1908. Describes a form of electric fuse.

938,558. DYNAMO-ELECTRIC MACHINE. Abe L. Cushman, Concord, N. H. Filed May 27, 1907. The field magnet has a series of poles with windings in shunt, and commutating pole-pieces with windings in magnetic circuit independent of the field circuit, these pole-pieces being arranged in pairs connected by a magnetic yoke, one member of each pair being within and one member being without the plane of the armature periphery.

938,588. SELF-LOCKING RELAY. Jerome F. Keely, Chicago, Ill. Filed January 16, 1909. A magnet in electrical connection with a clock-control switch has an insulated arm secured thereto adapted to open and close a time-recorder circuit switch; a similar arrangement, with a pivoted armature, is also provided, and the armatures are connected by a link so that each armature is self-locking and adapted to be unlocked by the other armature.

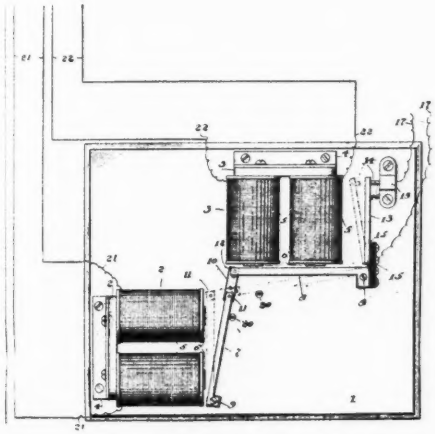
938,604. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Herbert S. Miller, Elizabeth, N. J., assignor to Diehl Manufacturing Company. Filed April 22, 1907. Describes a method of locking a flexible conducting lead in a recess in a carbon brush.

938,631. WIRELESS CLUSTER. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed June 10, 1907. A plate carried by an insulating block engages a variable number of the threaded contacts.

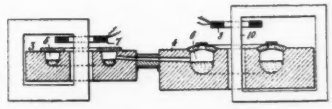
938,632. CLUSTER-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed October 28, 1907. Similar to the preceding.

938,635. PANEL-BOARD. Albert E. Blackman, Mount Vernon, N. Y. Filed October 15, 1908. The body portion forms a compartment which is provided with a metallic trim serving as a cover, the trim serving as a metallic faceplate for the operating members of the switches.

938,649. CONTROLLER FOR ELECTRIC MOTORS. Frederick Diehl, Elizabeth, N. J., assignor to Diehl Manufacturing Company. Filed May 11, 1908. An electric switch connected with the motor is provided with an actuating lever extended into the path of movement of the motor clutch-operating member, and a spring completes the throw of the switch lever initiated by its engagement with this member.



938,588.—SELF-LOCKING RELAY.



938,752.—METHOD OF WORKING METALS, ORES, AND THE LIKE.

938,752. METHOD OF WORKING METALS, ORES, AND THE LIKE. Otto Frick, Saltsjöbaden, Sweden. Filed August 31, 1905. The principal part of the charge is melted in one transformer furnace from which the melted material is conveyed into another transformer furnace, larger than the other, for the purpose of refining and storing it.

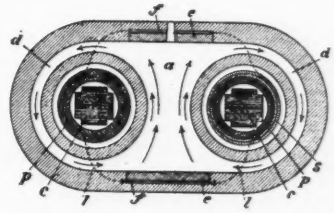
938,801. CARRIAGE-RETURN AND LINE-SPACING MECHANISM FOR TYPEWRITERS. Guillermo Trejo, Mexico, Mexico. Filed November 30, 1908. Is operated by an electric motor.

938,802. ADJUSTABLE SUSPENSION-CORD FOR ELECTRIC LAMPS. Thomas W. Trotter, Sault Ste. Marie, Ontario, Canada. Filed April 13, 1908. Describes a spool arrangement for the cord, in which electrical contacts engage spring arms.

938,805. GEARING. Alfred D. Williamson, Sheffield, England, assignor to Vickers Sons & Maxim, Limited, Sheffield, England. Filed May 18, 1908. Describes a change-speed gear connected with a reversible electric motor.

938,830. ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. Arthur T. Dawson and George T. Buckham, London, England, assignors to Vickers Sons & Maxim, Limited, Westminster, England. Filed November 27, 1905. A dynamo-electric sending device, connected to a counting device, actuates similar dynamo-electric devices step by step at the several receiving stations.

938,859. AUTOMATIC FIRE-EXTINGUISHER AND SIGNALING SYSTEM. Richard B. Hewitt and James G. Nolen, Chicago, Ill.; said Nolen assignor of one-half of his right to Frank B. Cook, Chicago, Ill. Filed May 29, 1903. Valves are electrically controlled.



939,095.—ELECTRIC FURNACE.

938,663. BATTERY-CONTACT. Julius H. Gugler, Minneapolis, Minn., assignor to the Battery Company. Filed February 21, 1908. The lead wire contacts with a mercury pocket in the base of the jar.

938,664. ELECTRIC SWITCH. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed May 5, 1909. Describes a form of push-button cam switch.

938,671. RESISTANCE UNIT. Harry W. Leonard, Bronxville, N. Y. Filed November 13, 1905. A reflexed ribbon conductor is supported edgewise between two protective sheet-metal supports.

938,672. BINDING-POST. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed April 2, 1908. A screw which engages a stationary member having connected opposing walls has an enlarged shoulder passing through one wall and adapted to clamp a conductor between it and the inside of the other wall.

938,682. OUTLET-BOX. James T. Meleady, Newark, N. J. Filed May 20, 1908. The conduit is received and secured by a sleeve passing through the side of the box and secured by a screw.

938,708. ELECTROMECHANICAL DEVICE. George H. Rowe, Riverside, Ill., assignor to Electro-Magnetic Tool Company, Chicago, Ill. Filed June 9, 1908. A number of electromechanically cushioned percussion devices, in balanced relation with respect to each other, are driven by a shaft to which they are connected.

938,709. ELECTROMECHANICAL DEVICE. George H. Rowe, Berwyn, Ill., assignor to Electro-Magnetic Tool Company, Chicago, Ill. Filed June 11, 1909. A magnet is provided with a hollow reciprocable core having an armature arranged to slide within it.

938,740. ELECTROMAGNETIC DEVICE. Einar A. Brofos, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Filed May 23, 1908. A fluctuating-current electromagnetic device has two electromagnets having separate cores forming portions of two distinct magnetic circuits; one is adapted to receive its current from a fluctuating-current source and the other to receive its current inductively from the former.

938,865. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed March 18, 1908. A main distributive circuit is connected in operative relation with a storage apparatus and booster, means being provided for producing a variable flux in the booster and other means for applying to the booster a rapidly reversing magnetomotive force.

938,936. ELECTRIC CONTROL FOR PANTOGRAPHS. Alfred T. Ziegler, Pittsburg, Pa. Filed January 22, 1909. The tracing point comprises an electromagnet having a movable core and a point detachably held by the core. A circuit-closer located on the frame has movable contacts adapted to establish a circuit through the electromagnet.

938,943. TELEPHONE EXCHANGE. Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan., assignors of two-thirds to the Anderson Electric and Manufacturing Company, McPherson, Kan., and one-third to Hagstrom Brothers Manufacturing Company, Lindsborg, Kan. Filed August 29, 1904. Describes an electromagnetic switching mechanism for a party-line exchange.

938,944. CALLING DEVICE FOR TELEPHONE-EXCHANGE. Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan., assignors to the Anderson Electric and Manufacturing Company, McPherson, Kan., and Hagstrom Brothers Manufacturing Company, Lindsborg, Kan. Filed April 19, 1906. Comprises a series of contact points, a pair of contact makers, a drive shaft normally disconnected from the contact makers, a clutch mechanism arranged to connect the contact makers to the shaft, and means by which upon operating the clutch mechanism the contact makers will make one complete cycle of operations and come to rest in their normal position.

938,949. AUTOMATIC TELEPHONE PAY-STATION. Francis X. Bee, Philadelphia, Pa. Filed April 10, 1908. Describes a coin-actuated telephone device in detail.

938,974. TELEPHONE-LINE-TESTING SYSTEM. Arthur N. Chenoweth, Waterbury, Conn. Filed August 6, 1908. Comprises terminal stations and connecting telephone lines, an intermediate testing-station or stations, means located at the

testing station or stations controlling the continuity of the telephone lines, and means located at the terminal station or stations operating the line controlling means automatically to open or bridge, at the testing station or stations, the desired telephone lines.

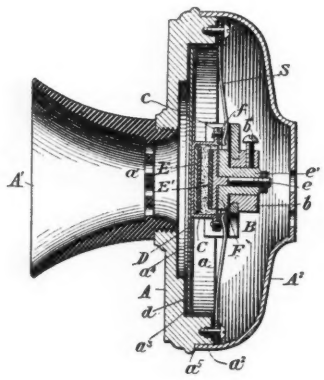
938,992. TELEPHONE-TRANSMITTER. Carl E. Egnér, Stockholm, and Johan G. Holmström, Saltsjö Storängen, Sweden. Filed February 18, 1909. The diaphragm, which is strained uniformly from center to periphery, is fixed at its center to a disk which vibrates in unison with that part of the diaphragm to which it is secured. The disk forms one of the electrodes of the transmitter.

939,006. STORAGE BATTERY. Gerhard M. W. Goettling, Brookline, Mass. Filed January 4, 1909. Describes special means for suspending the plates.

939,054. ELECTRIC WATER-HEATER. Paul P. Meyers, Grinnell, Iowa, assignor of one-half to Okey K. Cole, Grinnell, Iowa. Filed January 2, 1909. A body portion having an inlet and discharge opening contains two electrodes to each of which are detachably connected several electrode members, those on one electrode being interposed between, and spaced apart from, the members on the other electrode.

939,095. ELECTRIC FURNACE. Hermann Röchling and Wilhelm Rodenhauser, Völklingen, Germany, assignors to the Gröndal Kjellin Company, Limited, London, England. Filed September 7, 1906. Comprises a magnet core (c in Illustration), piercing the furnace and having a primary (p) and a secondary (s) winding, the smelting room in the furnace being formed by an annular channel (d) surrounding the magnet core.

939,106. HAIR-DRYING APPARATUS. William A. Soles, New York, N. Y. Filed December 14, 1908. Air circulated by an electric fan is driven past electric lamps to heat it, the light from the lamps serving to illuminate the hair.



13,035.—TELEPHONE TRANSMITTER.

939,110. CONTROLLING-SWITCH FOR MOVING-PICTURE MACHINES AND STEREOPTICONS. Tomotaka Taira, Fresno, Cal. Filed April 6, 1909. Separated switch terminals are directly included in an electric-lamp circuit, and two independently operated bridging contact plates are adapted independently to close the circuit through the switch terminals.

939,128. FIRE-ALARM. Walter Goodchild, New York, N. Y., assignor to John Goodchild, New York, N. Y. Filed March 18, 1909. A circuit-closing means for fire-alarm devices and the like has a mercurial thermometer tube provided with a pendent, laterally-bent upper portion sealed at its lower extremity and adapted to receive the mercurial column upon elevation of temperature, spaced terminals embedded in the pendent, laterally-bent portion of the tube and adapted for communication through the mercurial column upon the rise of temperature, and a metallic casing arranged to enclose the sealed extremity of the pendent portion of the tube to prevent fracture thereof.

939,154. ELECTRIC CONTROLLING AND SIGNALING SYSTEM FOR RAILWAYS. Herbert E. McDonnell, Leominster, Mass. Original application filed August 7, 1906. Divided and this application filed January 26, 1907. A tram or car approaching an open switch closes an electric circuit causing a motor and brakes to operate.

939,155. ELECTRIC TIME-FUSE. Claud D. McPhee, Arnprior, and John Gillies, Braeside, Ontario, Canada. Filed January 14, 1909. A detonating cap is located in contact with a powder cartridge, the latter being explodable by an electric means inserted therein.

939,165. HOOD FOR ELECTRICAL WIRING ON STANDPIPES. John Potterton, Lynn, Mass. Filed January 21, 1908. A hood, covering the top of the pipe cap and embracing the rear of a standpipe, is cleft from front to rear so as to constitute a tongue-and-groove joint between the two portions so separated, and a separable piece embraces the front of the pipe under the hood, fastening the two portions together.

939,183. PROCESS OF GENERATING ELECTRICITY. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed April 18, 1903. Divided and this application filed April 29, 1907. A molten electrolyte has in communication with, but separated from it, electrodes, the electropositive one of which contains metal carbide decomposable by the electrolyte.

939,186. SELECTIVE APPARATUS FOR SYSTEMS OF COMMUNICATION. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio. Filed October 11, 1906. A cable or set of trunk wires is connected in multiple to corresponding terminals in all of a set of relays, each of which relays contains terminals of a number of electrical circuits, and each of a supplementary set of relays controls a branch from one only of the cable wires.

939,187 and 939,188. METHOD OF SELECTION IN SYSTEMS OF COMMUNICATION. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio. Filed October 11, 1906. Describe methods of interconnection of the electrical circuits in the apparatus described in the previous number.

REISSUE.

13,035. TELEPHONE-TRANSMITTER. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company. Filed May 17, 1909. Original No. 823,768, dated June 19, 1906. Comprises a vibrating diaphragm, an independently-supported cup resting with its bottom against the diaphragm, the other parts of the cup being free from the diaphragm, an electrode supported by the cup, springs pressing the cup against said diaphragm, a second electrode independently and rigidly fixed with respect to the first, and granular conducting material between the electrodes in the cup.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 8, 1909:

485,618. APPARATUS FOR, AND PROCESS OF, REFINING COPPER BY ELECTRICITY. Franklin Farrel, Ansonia, Conn.

485,619. RHEOSTATIC CONTROLLER FOR ELECTRIC MOTORS. Jonathan P. B. Fiske, Lynn, Mass.

485,620. ELECTRIC MOTOR CONTROLLER. Jonathan P. B. Fiske, Lynn, Mass.

485,643. SWITCHBOARD FOR ELECTRIC-LIGHT CIRCUITS. John J. Moore and Catharine M. Henry, New York, N. Y.

485,645. ELECTRIC CLOCK. James D. McAnlis and Harvey E. Fleming, Beaver Falls, Pa.

485,658 and 485,659. ELECTRIC TRANSMISSION OF POWER. Edwin W. Rice, Jr., Lynn, Mass.

485,668. ELECTRIC RAILWAY SWITCH. Charles A. Stone and Edwin S. Webster, Boston, Mass.

485,669. CONTINUOUS-CURRENT TRANSFORMER. Elihu Thomson, Swampscott, Mass.

485,682. INCANDESCENT ELECTRIC LAMP. Augustus C. Carey, Lake Pleasant, Mass.

485,728. ELECTRIC RAILWAY SIGNAL. Adoniram J. Wilson, Port Chester, N. Y.

485,744. ELECTRIC ARC LAMP. George Kirkegaard, Brooklyn, N. Y.

485,754. ELECTRIC BELT. Emory N. X. Tefft, Iola, Kan.

485,767. ELECTRIC PERFORATING PEN. Aaron D. Lewis, Canton, Mo.

485,859. TELEPHONY. William Bruening, East Orange, N. J.

485,876. TELEPHONE. James W. McDonough, New York, N. Y.

485,895. ELECTRIC ARC LAMP. James R. Steers, New York, N. Y.

485,950. AUTOMATIC ELECTRIC SCALE. Paul J. Kuhbacher, Ashland, Ky.

486,029. ELECTRIC FORGE. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,051. TELEGRAPH SOUNDER. James Maret, Mount Vernon, Ky., and William L. De Graff, Homer, Mich.